



EESC • USP

USP

SEM0104 – Aula 9

Exemplo de Aplicação: Software TEPiciclo

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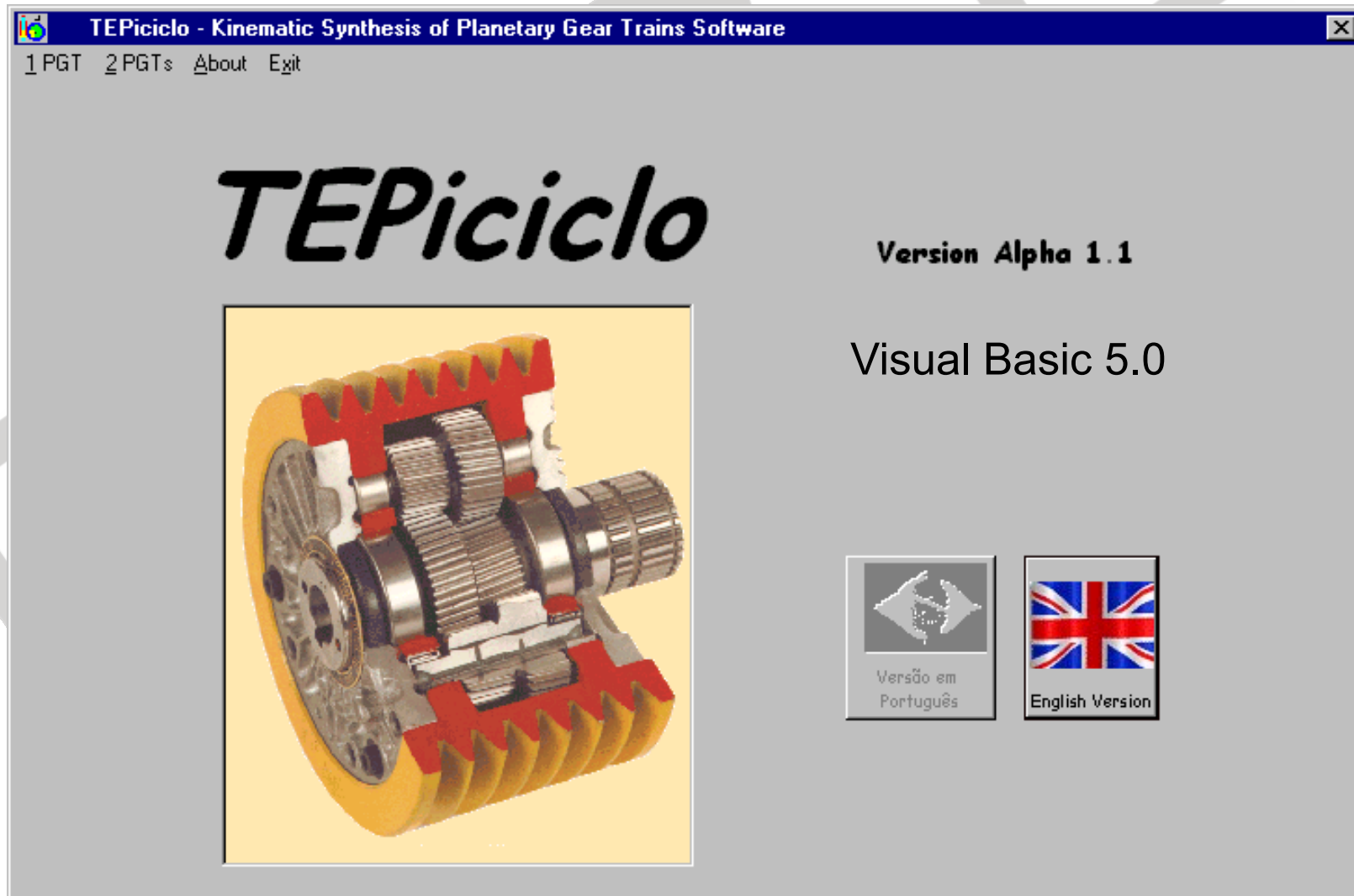
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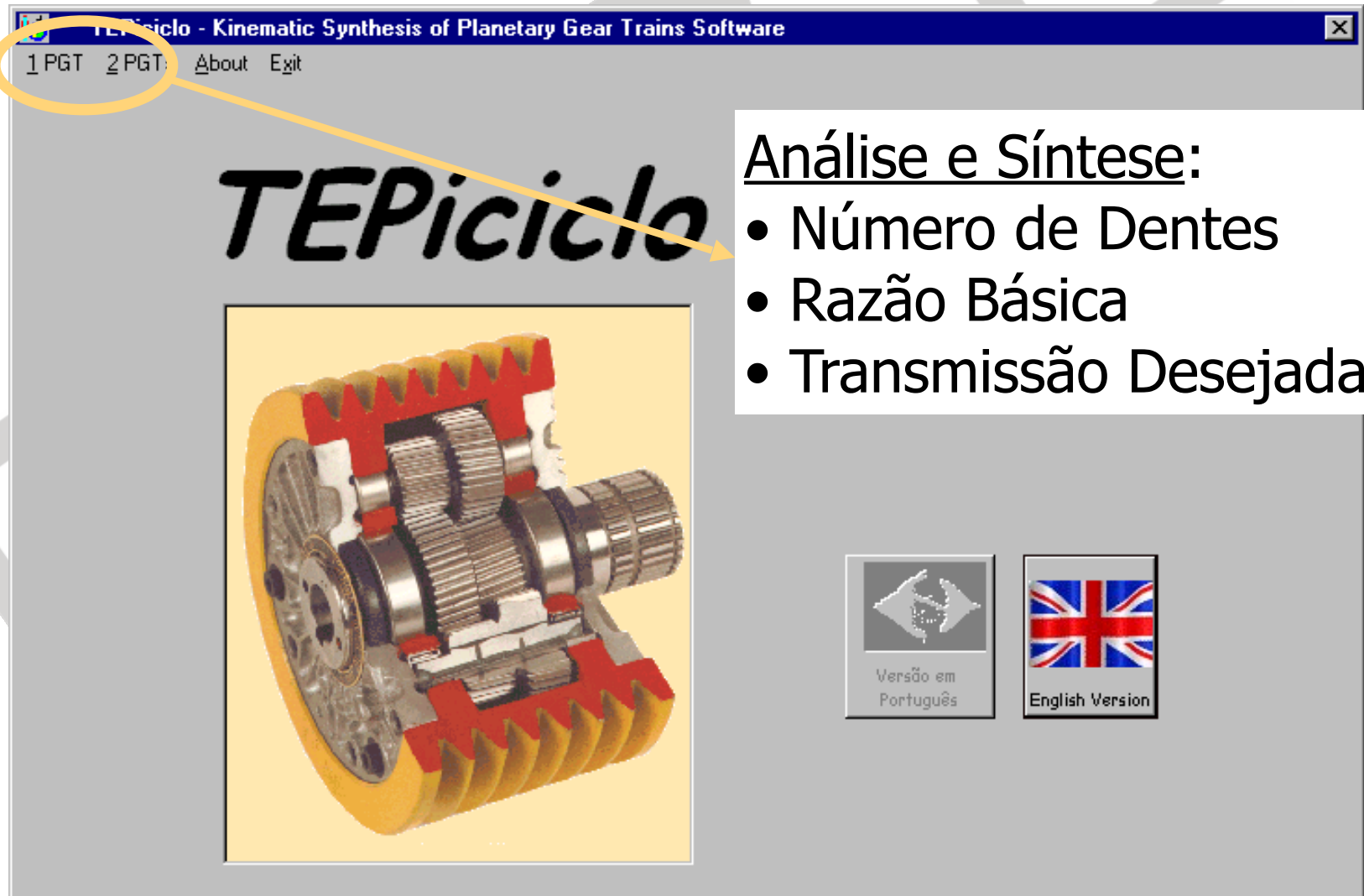
Sumário da Aula

- **Software TEPiciclo**
- Exemplo 1 TEP: Análise
- Exemplo 1 TEP: Síntese
- Exemplo 2 TEPs: Análise
- Exemplo 2 TEPs: Síntese

Software TEPiciclo



Software TEPiciclo



Sumário da Aula

- Software TEPiciclo
- **Exemplo 1 TEP: Análise**
- Exemplo 1 TEP: Síntese
- Exemplo 2 TEPs: Análise
- Exemplo 2 TEPs: Síntese

Exemplo 1 TEP: Análise

Software TEPiciclo – Número de Dentes

1 PGT - Determination of the Kinematic Relations through the Number of Teeth

File Print Results Back Exit

PGT Configuration

Driving Data

Motors Quantity: only 1 2 motors

Clutch Position: Motor 1: Sun

Velocity (rpm): 1200

Direction: clockwise

PGT Output(s) Data

1 output 2 outputs


Output Position: Ring

Fixed Element: [] Confirm Change

PGT Diagram

Gears Characteristics

Planets Quantity: 3



Teeth Quantity

Teeth Quantity in the Sun: 30

Teeth Quantity in the Planets: 26

Teeth Quantity in the Ring: 82

Confirm Change Cancel

Kinematic Results

PGT Type: []

Gear Ratio: []

Output Angular Velocity (rpm): []

Torque Analysis Change

Alterations:

Configuration Gears Characteristics

Ok Cancel

Exemplo 1 TEP: Análise

Software TEPiciclo – Número de Dentes

1 PGT - Determination of the Kinematic Relations through the Number of Teeth

File Print Results Back Exit

PGT Configuration

Driving Data

Motors Quantity: only 1 2 motors

Clutch Position: Motor 1: Sun

Velocity (rpm): 1200

Direction: clockwise

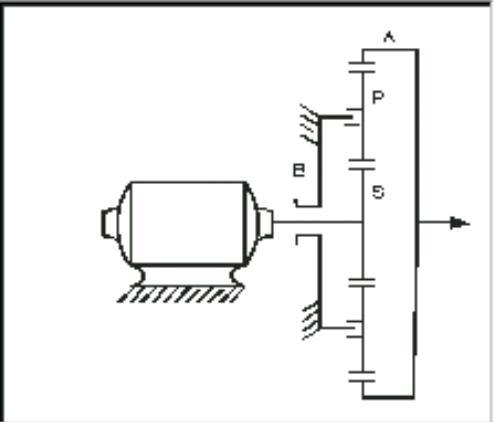
PGT Output(s) Data

1 output 2 outputs

Output Position: Ring


Fixed Element: **Arm**

PGT Diagram



Gears Characteristics

Planets Quantity: 3



Teeth Quantity

Teeth Quantity in the Sun: 30

Teeth Quantity in the Planets: 26

Teeth Quantity in the Ring: 82

Kinematic Results

PGT Type:

Gear Ratio:

Output Angular Velocity (rpm):

Alterations:

Configuration Gears Characteristics

Exemplo 1 TEP: Análise

Software TEPiciclo – Número de Dentes

1 PGT - Determination of the Kinematic Relations through the Number of Teeth

File Print Results Back Exit

1 PGT Torque Analysis

Close View Print

PGT Data

Teeth Quantity:

Ring: 82

Sun: 30

Planets: 26

Train Value: -0.366

OK Cancel

PGT Diagram

Results

Values as a function of τ_{in} :

τ_1 : 2.733 $\times \tau_{in}$

τ_2 : -1.867 $\times \tau_{in}$

τ_3 : -0.867 $\times \tau_{in}$

τ_4 : -1.867 $\times \tau_{in}$

τ_5 : 0.867 $\times \tau_{in}$

τ_6 : 1.0 $\times \tau_{in}$

τ_r : -3.733 $\times \tau_{in}$

τ_{out} : -2.733 $\times \tau_{in}$

The calculated values are a function of the input Torque τ_{in} and the signals (+) or (-) indicate the Torque Flow Direction.

Values in modulus and as a function of τ_{in}

Component	Value
τ_1	2.73
τ_2	1.87
τ_3	0.87
τ_4	1.87
τ_5	0.87
τ_6	1.00
τ_r	3.73
τ_{out}	2.73

Confirm Change Cancel

Exemplo 1 TEP: Análise

Software TEPiciclo – Número de Dentes

1 PGT - Determination of the Kinematic Relations through the Number of Teeth

File Print Results Back Exit

PGT Configuration

Driving Data

Motors Quantity: only 1 2 motors

Clutch Position: Motor 1: Sun

Velocity (rpm): 1200

Direction: clockwise

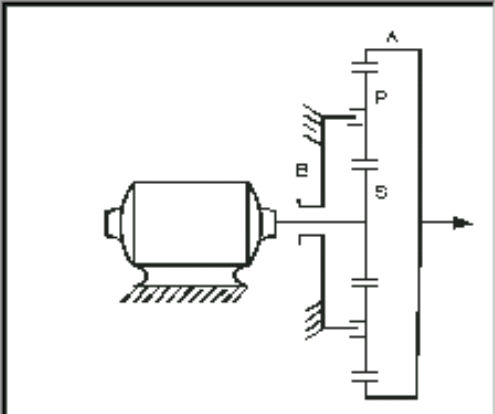
PGT Output(s) Data

1 output 2 outputs

Output Position: Ring


Fixed Element: **Arm**

PGT Diagram



Gears Characteristics

Planets Quantity: 3



Teeth Quantity

Teeth Quantity in the Sun: 30

Teeth Quantity in the Planets: 26

Teeth Quantity in the Ring: 82

Kinematic Results

PGT Type: **Reverse Reduction Gearbox**

Gear Ratio: - 2.733 : 1

Output Angular Velocity (rpm): - 439.0

Alterations:

Configuration Gears Characteristics

Exemplo 1 TEP: Análise

Software TEPiciclo – Número de Dentes

1 PGT - Determination of the Kinematic Relations through the Number of Teeth

File Print Results Back Exit

PGT Configuration

Driving Data

Motors Quantity: only 1 2 motors

Clutch Position: Motor 1: Sun Motor 2: Ring

Velocity (rpm): 1200 3400

Direction: clockwise clockwise


PGT Output(s) Data

1 output Output Element:

Fixed Element: none Confirm Change

PGT Diagram

Gears Characteristics

Planets Quantity: 3 

Teeth Quantity

Teeth Quantity in the Sun: 30

Teeth Quantity in the Planets: 26

Teeth Quantity in the Ring: 82

Confirm Change Cancel

Kinematic Results

Output Angular Velocity (rpm): Plot

Torque Analysis Change

Alterations:

Configuration Gears Characteristics Ok Cancel

Exemplo 1 TEP: Análise

Software TEPiciclo – Número de Dentes

1 PGT - Determination of the Kinematic Relations through the Number of Teeth

File Print Results Back Exit

PGT Configuration

Driving Data

Motors Quantity: only 1 2 motors

Clutch Position: Motor 1: Sun Motor 2: Ring

Velocity (rpm): 1200 3400

Direction: clockwise clockwise

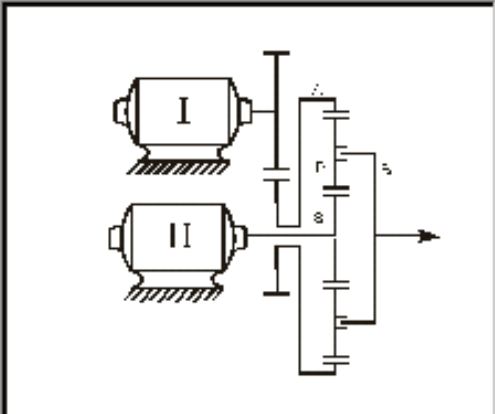
PGT Output(s) Data

1 output Output Element: Arm

Fixed Element: none


Confirm Change

PGT Diagram



Gears Characteristics

Planets Quantity: 3



Teeth Quantity

Teeth Quantity in the Sun: 30

Teeth Quantity in the Planets: 26

Teeth Quantity in the Ring: 82

Confirm Change Cancel

Kinematic Results

Output Angular Velocity (rpm): 1789.3

Plot

Torque Analysis Change

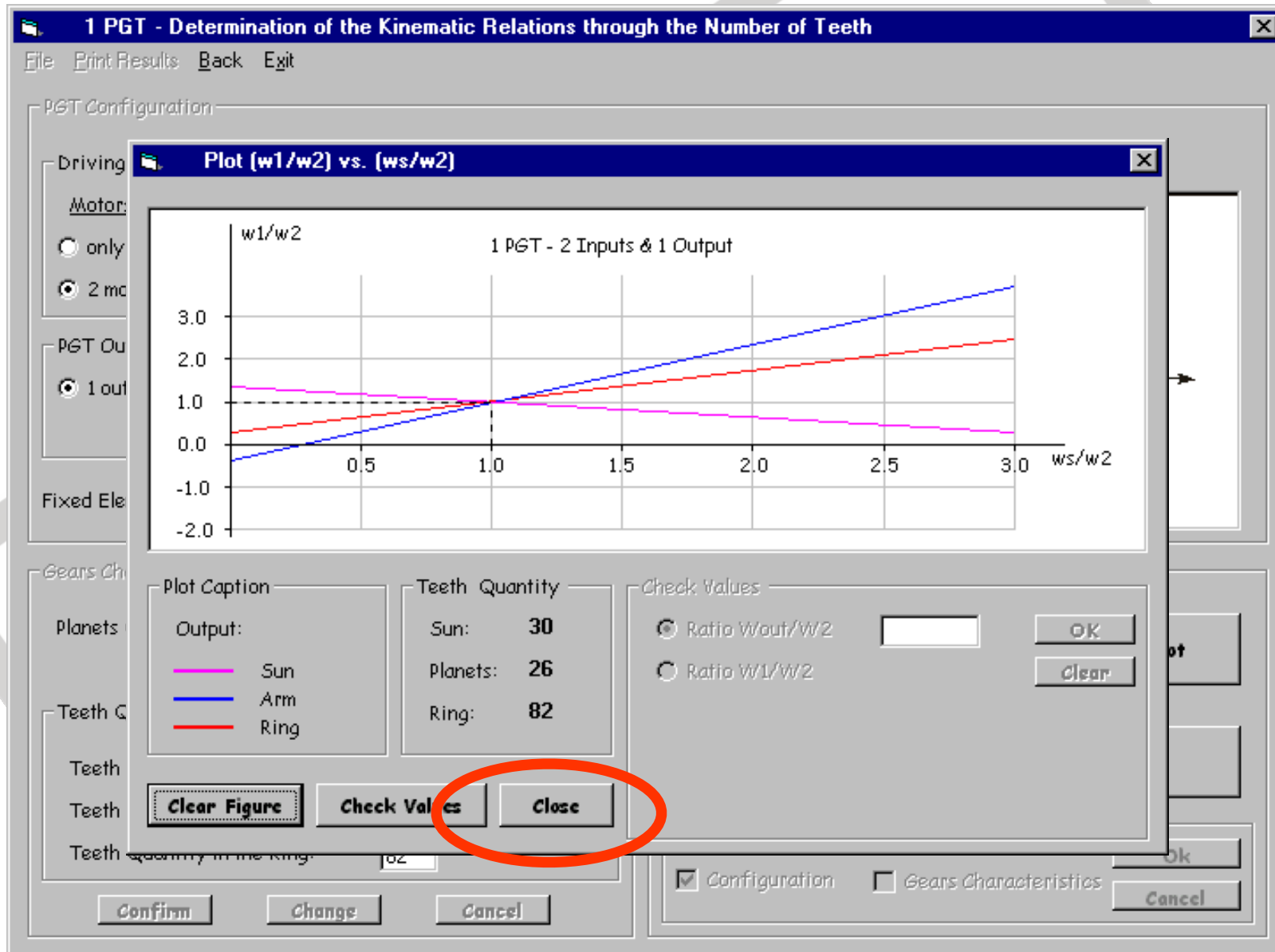
Alterations:

Configuration Gears Characteristics

Ok Cancel

Exemplo 1 TEP: Análise

Software TEPiciclo – Número de Dentes



Exemplo 1 TEP: Análise

Software TEPiciclo – Número de Dentes

1 PGT - Determination of the Kinematic Relations through the Number of Teeth

File Print Results Back Exit

PGT Configuration

Driving Data

Motors Quantity: only 1 2 motors

Clutch Position: Motor 1: Sun

Velocity (rpm): 1200

Direction: clockwise

PGT Output(s) Data

1 output 2 outputs

Ratio between the Outputs: $\omega_{ring} = 0.7 \omega_{Arm}$

Fixed Element: none

Confirm Change

PGT Diagram

Gears Characteristics

Planets Quantity: 3

Teeth Quantity

Teeth Quantity in the Sun: 30

Teeth Quantity in the Planets: 26

Teeth Quantity in the Ring: 82

Confirm Change Cancel

Kinematic Results

Output Velocity of the Arm (rpm):

Output Velocity of the Ring (rpm):

Torque Analysis Change

Alterations:

Configuration Gears Characteristics

Ok Cancel

Exemplo 1 TEP: Análise

Software TEPiciclo – Número de Dentes

1 PGT - Determination of the Kinematic Relations through the Number of Teeth

File Print Results Back Exit

PGT Configuration

Driving Data

Motors Quantity: only 1 2 motors

Clutch Position: Motor 1: Sun

Velocity (rpm): 1200

Direction: clockwise

PGT Output(s) Data

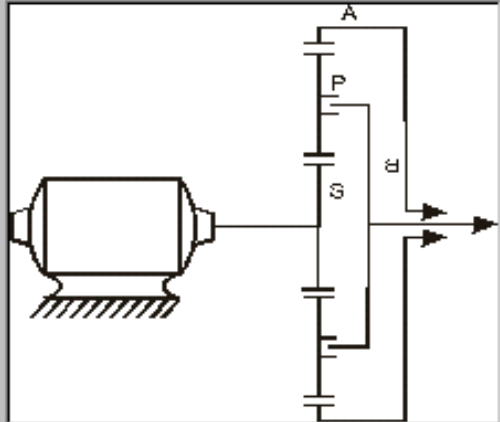
1 output 2 outputs

Ratio between the Outputs: $\omega_{\text{ring}} = 0.7 \omega_{\text{Arm}}$

Fixed Element: none


Confirm Change

PGT Diagram



Gears Characteristics

Planets Quantity: 3



Teeth Quantity

Teeth Quantity in the Sun: 30

Teeth Quantity in the Planets: 26

Teeth Quantity in the Ring: 82

Confirm Change Cancel

Kinematic Results

Output Velocity of the Arm (rpm): 659.3

Output Velocity of the Ring (rpm): 461.5

Torque Analysis Change

Alterations:

Configuration Gears Characteristics

Ok Cancel

Exemplo 1 TEP: Análise

Software TEPiciclo – Número de Dentes

1 PGT - Determination of the Kinematic Relations through the Number of Teeth

File Print Results Back Exit

1 PGT Torque Analysis

Close View Print

PGT Data

Teeth Quantity:

Ring: 82

Sun: 30

Planets: 26

Train Value: -0.366

OK Cancel

PGT Diagram

Results

Values as a function of τ_{in} :

τ_1 : 2.733 $\times \tau_{in}$

τ_2 : -1.867 $\times \tau_{in}$

τ_3 : -0.867 $\times \tau_{in}$

τ_4 : -1.867 $\times \tau_{in}$

τ_5 : 0.867 $\times \tau_{in}$

τ_6 : 1.0 $\times \tau_{in}$

τ_{oI} : -2.733 $\times \tau_{in}$

τ_{oII} : 3.733 $\times \tau_{in}$

The calculated values are a function of the input Torque τ_{in} and the signals (+) or (-) indicate the Torque Flow Direction.

Values in modulus and as a function of τ_{in}

τ_1 2.73 τ_2 1.87 τ_3 0.87 τ_4 1.87 τ_5 0.87 τ_6 1.00 τ_{oI} 2.73 τ_{oII} 3.73

G1 G2

Confirm Change Cancel

Exemplo 1 TEP: Análise

Software TEPiciclo – Razão Básica

1 PGT - Determination of the Kinematic Relations through the Train Value

File Print Results Back Exit

PGT Configuration

Driving Data

Motors Quantity: only 1 2 motors

Clutch Position: Motor 1: Ring

Velocity (rpm): 3000

Direction: clockwise

PGT Output(s) Data


1 output 2 outputs

Posição desejada para a saída: Arm

Fixed Element: Confirm Change

PGT Diagram

Gears Characteristics

Planets Quantity: 3 

Train Value

Train Value (b) -0.904 to -0.048

Confirm Change Cancel

Kinematic Results

PGT Type:

Gear Ratio:

Output Angular Velocity (rpm):

Torque Analysis Change

Alterations:

Configuration Gears Characteristics

Ok Cancel

Exemplo 1 TEP: Análise

Software TEPiciclo – Razão Básica

1 PGT - Determination of the Kinematic Relations through the Train Value

File Print Results Back Exit

PGT Configuration

Driving Data

Motors Quantity: only 1 2 motors

Clutch Position: Motor 1: Ring

Velocity (rpm): 3000

Direction: clockwise

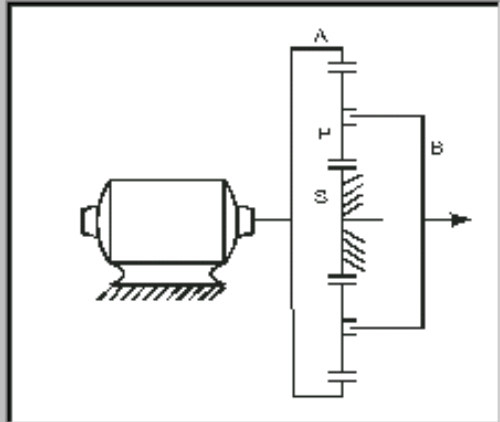
PGT Output(s) Data

1 output 2 outputs


Posição desejada para a saída: Am

Fixed Element: Sun

PGT Diagram



Gears Characteristics

Planets Quantity: 3 

Train Value

Train Value (b) -0.57 -0.904 to -0.048

Kinematic Results

PGT Type: Reduction Gearbox

Gear Ratio: 1.570 : 1

Output Angular Velocity (rpm): 1910.8

Alterations:

Configuration Gears Characteristics

Exemplo 1 TEP: Análise

Software TEPiciclo – Razão Básica

1 PGT - Determination of the Kinematic Relations through the Train Value

File Print Results Back Exit

PGT Configuration

Driving Data

Motors Quantity: only 1 2 motors

Clutch Position: Motor 1: Ring

Velocity (rpm): 3000

Direction: clockwise

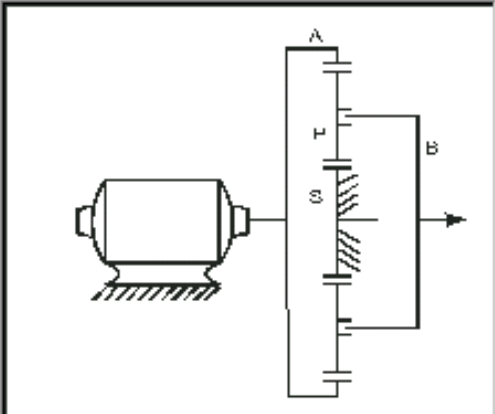
PGT Output(s) Data

1 output 2 outputs

Posição desejada para a saída: Am


Fixed Element: Sun

PGT Diagram



Gears Characteristics

Planets Quantity: 3



Train Value

Train Value (b) -0.57 -0.904 to -0.048

Kinematic Results

PGT Type: Reduction Gearbox

Gear Ratio: 1.570 : 1

Output Angular Velocity (rpm): 1910.8

Alterations:

Configuration Gears Characteristics

Exemplo 1 TEP: Análise

Software TEPiciclo – Razão Básica

The screenshot displays the '1 PGT - Determination of the Kinematic Relations through the Train Value' window. The 'Parameters Selection for the Torque Analysis' dialog box is open, showing the following configuration:

- Driving Data:** Motors Quantity: only 1; Clutch Position: Motor 1: Ring; Velocity (rpm): 3000.
- PGT Output(s) Data:** 1 output; Posição desejada para a saída: (empty).
- Fixed Element:** Sun.
- Gears Characteristics:** Planets Quantity: 3. A diagram of a planetary gear set with 3 planets is shown.
- Train Value:** (b) -0.57, range -0.904 to -0.048.

The 'Parameters Selection for the Torque Analysis' dialog box includes:

- Limiting Parameters for the search:** Train Value **b: -0.57**; Limit the Gears Teeth Quantity.
- Desired Interval:** Ring: [] to []; Sun: [] to []; Planets: [] to [].
- Values Set:** Ring: 36 to 250; Sun: 12 to 226; Planets: 12 to 119.
- Buttons:** Confirm (circled in red), Change, Cancel.

At the bottom of the dialog box, there are buttons for 'Torque Analysis' (highlighted with a dashed box), 'Change', and 'Alterations' (with checkboxes for Configuration and Gears Characteristics, and buttons for Ok and Cancel).

Exemplo 1 TEP: Análise

Software TEPiciclo – Razão Básica

1 PGT - Determination of the Kinematic Relations through the Train Value

File Print Results Back Exit

PST Configuration

Driving Data

PGT Diagram

Parameters Selection for the Torque Analysis

Limiting Parameters for the search

Train Value **b: -0.57**

Limit the Gears Teeth Quantity

Desired Interval: Values Set:

Ring: [] to [] 36 to 250

Sun: [] to [] 12 to 226

Planets: [] to [] 12 to 119

Confirm Change Cancel

Results

Select the PGT for the Torque Analysis:

PGT: **11 options**

- Zr = 65 Zs = 37 Zp = 14
- Zr = 79 Zs = 45 Zp = 17
- Zr = 93 Zs = 53 Zp = 20
- Zr = 107 Zs = 61 Zp = 23
- Zr = 121 Zs = 69 Zp = 26
- Zr = 135 Zs = 77 Zp = 29
- Zr = 172 Zs = 98 Zp = 37
- Zr = 186 Zs = 106 Zp = 40

Change Cancel Confirm

Train Value

Train Value (b) [-0.57] -0.904 to -0.048

Confirm Change Cancel

Torque Analysis Change

Alterations:

Configuration Gears Characteristics

Ok Cancel

Exemplo 1 TEP: Análise

Software TEPiciclo – Razão Básica

The screenshot displays the '1 PGT - Determination of the Kinematic Relations through the Train Value' software interface. A '1 PGT Torque Analysis' dialog box is open, showing the following data:

PGT Data	
Teeth Quantity:	
Ring	65
Sun	37
Planets	14
Train Value	-0.57

The 'OK' button in the dialog box is circled in red. The background window shows configuration options for driving data (Motors Quantity: only 1, Clutch Position: Ring), PGT Output(s) Data (1 output), Fixed Element (Sun), Planets Quantity (3), and Train Value (-0.57). A PGT Diagram is visible on the right side of the background window.

Exemplo 1 TEP: Análise

Software TEPiciclo – Razão Básica

1 PGT - Determination of the Kinematic Relations through the Train Value

File Print Results Back Exit

1 PGT Torque Analysis

Close View Print

PGT Data:

Teeth Quantity:

Ring: 65

Sun: 37

Planets: 14

Train Value: -0.57

OK Cancel

PGT Diagram

Results

Values as a function of τ_{in} :

τ_1 : 1.0 $\times \tau_{in}$

τ_2 : -0.785 $\times \tau_{in}$

τ_3 : -0.215 $\times \tau_{in}$

τ_4 : -0.785 $\times \tau_{in}$

τ_5 : 0.215 $\times \tau_{in}$

τ_6 : 0.569 $\times \tau_{in}$

τ_r : 0.569 $\times \tau_{in}$

τ_{out} : 1.569 $\times \tau_{in}$

The calculated values are a function of the input Torque τ_{in} and the signals (+) or (-) indicate the Torque Flow Direction.

Values in modulus and as a function of τ_{in}

τ_1 1.00

τ_2 0.78

τ_3 0.22

τ_4 0.78

τ_5 0.22

τ_6 0.57

τ_r 0.57

$\tau_{out} \times \tau_{in}$ 1.57

G1 G2

Confirm Change Cancel

Exemplo 1 TEP: Análise

Software TEPiciclo – Razão Básica

1 PGT - Determination of the Kinematic Relations through the Train Value

File Print Results Back Exit

1 PGT Torque Analysis

Close View Print

PGT Data

Teeth Quantity:

Ring: 65

Sun: 37

Planets: 14

Train Value: -0.57

OK Cancel

PGT Diagram

Torque Diagram

Values in modulus and as a function of τ_{in}

Component	Torque (τ)	Modulus
τ_1	1.00	1.00
τ_2	0.78	0.78
τ_3	0.22	0.22
τ_4	0.78	0.78
τ_5	0.57	0.57
τ_6	0.57	0.57
τ_r	0.57	0.57
$\tau_{out} \times \tau_{in}$	1.57	1.57

Confirm Change Cancel

Sumário da Aula

- Software TEPiciclo
- Exemplo 1 TEP: Análise
- **Exemplo 1 TEP: Síntese**
- Exemplo 2 TEPs: Análise
- Exemplo 2 TEPs: Síntese

Exemplo 1 TEP: Síntese

Software TEPiciclo – Transmissão

1 PGT - Determination of the Kinematic Relation through the Gear Ratio

File Back Print Exit

Driving Data

Angular Velocity rpm Direction

Gear Ratio

Gear Ratio Value: :1

Possible Ratio Values Sets for teeth quantity from 12 to 250:

Reduction	1.048 to 1.904	2.106 to 21.833
Reverse Reduction	-1.106 to -20.833	
Multiplication	0.046 to 0.474	0.525 to 0.954
Reverse Multiplication	-0.048 to -0.904	

Results

Limiting Data to search the tiple teeth set

Gear Ratio Tolerance (0.01 to 10 %)

Limit the Gears Teeth Quantity

Desired Teeth Interval: Values Set:

Ring: to 36 to 250

Sun: to 12 to 226

Planets: to 12 to 119

The PGTs quantity that satisfies the conditions is:

Possible Solutions:

Gear Ratio Interval (GR):

Selected Solutions:

Exemplo 1 TEP: Síntese

Software TEPiciclo – Transmissão

1 PGT - Determination of the Kinematic Relation through the Gear Ratio

File Back Print Exit

Driving Data

Angular Velocity: rpm Direction:

Gear Ratio

Gear Ratio Value: :1

PGT Type: **Reduction Gearbox**

Output Velocity: **263.2** rpm

PGT Diagram

Results

Limiting Data to search the triple teeth set

Gear Ratio Tolerance (0.01 to 10 %)

Limit the Gears Teeth Quantity

	Desired Teeth Interval:	Values Set:
Ring:	<input type="text"/> to <input type="text"/>	36 to 250
Sun:	<input type="text"/> to <input type="text"/>	12 to 226
Planets:	<input type="text"/> to <input type="text"/>	12 to 119

The PGTs quantity that satisfies the conditions is:

Possible Solutions:

Gear Ratio Interval (GR):

Selected Solutions:

Torque Analysis

Exemplo 1 TEP: Síntese

Software TEPiciclo – Transmissão

1 PGT - Determination of the Kinematic Relation through the Gear Ratio

File Back Print Exit

Driving Data

Angular Velocity: rpm Direction:

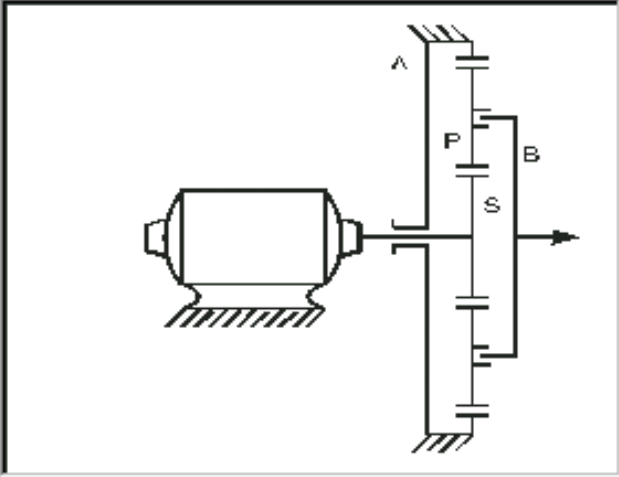
Gear Ratio

Gear Ratio Value: :1

PGT Type: **Reduction Gearbox**

Output Velocity: **263.2** rpm

PGT Diagram



Results

Limiting Data to search the triple teeth set

Gear Ratio Tolerance (0.01 to 10 %)

Limit the Gears Teeth Quantity

	Desired Teeth Interval:	Values Set:
Ring:	<input type="text"/> to <input type="text"/>	36 to 250
Sun:	<input type="text"/> to <input type="text"/>	12 to 226
Planets:	<input type="text"/> to <input type="text"/>	12 to 119

The PGTs quantity that satisfies the conditions is:

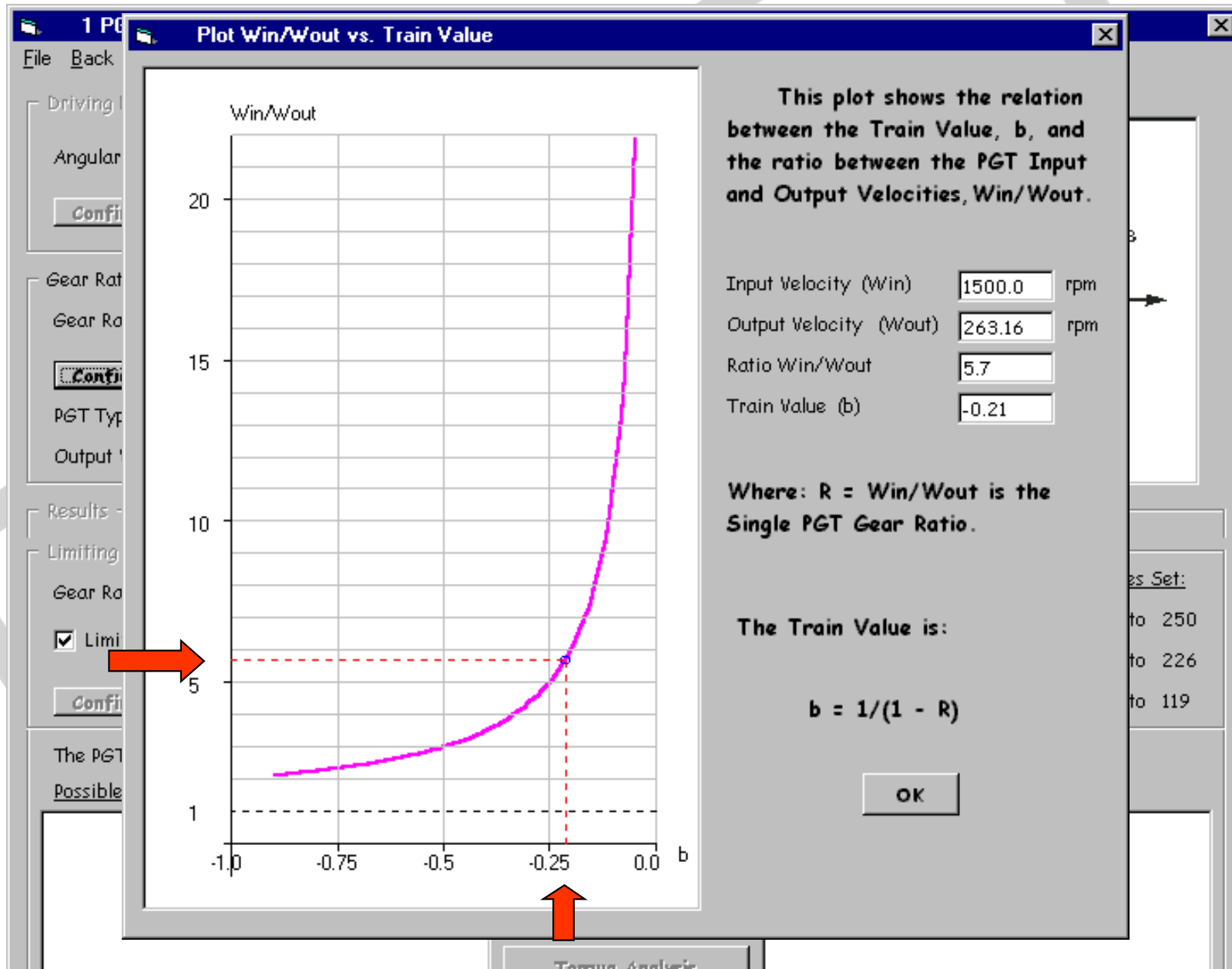
Possible Solutions:

Selected Solutions:

Torque Analysis

Exemplo 1 TEP: Síntese

Software TEPiciclo – Transmissão



Exemplo 1 TEP: Síntese

Software TEPiciclo – Transmissão

1 PGT - Determination of the Kinematic Relation through the Gear Ratio

File Back Print Exit

Driving Data

Angular Velocity: rpm Direction:

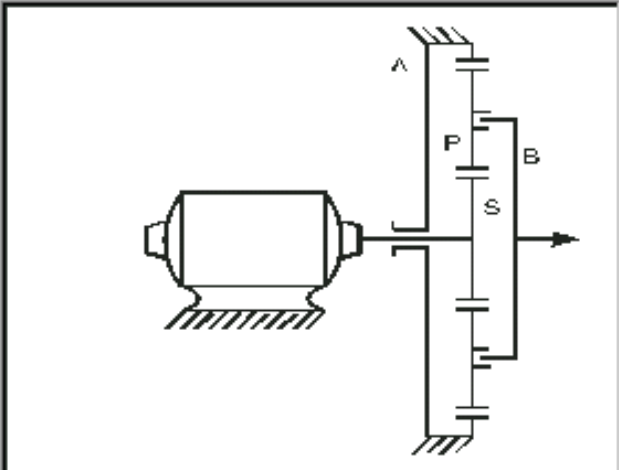
Gear Ratio

Gear Ratio Value: :1

PGT Type: **Reduction Gearbox**

Output Velocity: **263.2** rpm

PGT Diagram



Results

Limiting Data to search the triple teeth set

Gear Ratio Tolerance (0.01 to 10 %)

Limit the Gears Teeth Quantity

	Desired Teeth Interval:	Values Set:
Ring:	<input type="text"/> to <input type="text"/>	36 to 250
Sun:	<input type="text"/> to <input type="text"/>	12 to 226
Planets:	<input type="text"/> to <input type="text"/>	12 to 119

The PGTs quantity that satisfies the conditions is:

Possible Solutions:

Selected Solutions:

Torque Analysis

Exemplo 1 TEP: Síntese

Software TEPiciclo – Transmissão

1 PGT - Determination of the Kinematic Relation through the Gear Ratio

File Back Print Exit

Driving Data

Angular Velocity: rpm Direction:

Gear Ratio

Gear Ratio Value: :1

PGT Type: **Reduction Gearbox**

Output Velocity: **263.2** rpm

PGT Diagram

Results

Limiting Data to search the triple teeth set

Gear Ratio Tolerance (0.01 to 10 %)

Limit the Gears Teeth Quantity

Desired Teeth Interval:	Values Set:
Ring: <input type="text"/> to <input type="text"/>	36 to 250
Sun: <input type="text"/> to <input type="text"/>	12 to 226
Planets: <input type="text"/> to <input type="text"/>	12 to 119

The PGTs quantity that satisfies the conditions is: **5** Gear Ratio Interval (GR): **5.694 to 5.706**

Possible Solutions:

<input checked="" type="checkbox"/> Zr = 61 Zs = 13 Zp = 24 GR = 5.692
<input type="checkbox"/> Zr = 122 Zs = 26 Zp = 48 GR = 5.692
<input type="checkbox"/> Zr = 155 Zs = 33 Zp = 61 GR = 5.697
<input type="checkbox"/> Zr = 183 Zs = 39 Zp = 72 GR = 5.692
<input type="checkbox"/> Zr = 216 Zs = 46 Zp = 85 GR = 5.696

Selected Solutions:

<input checked="" type="checkbox"/> Zr = 61 Zs = 13 Zp = 24 GR = 5.692
--

Exemplo 1 TEP: Síntese

Software TEPiciclo – Transmissão

1 PGT - Determination of the Kinematic Relation through the Gear Ratio

File Back Print Exit

Driving Data:
 Angular Velocity: rpm Direction:

Gear Ratio:
 Gear Ratio Value: :1

 PGT Type: **Reduction Gearbox**
 Output Velocity: **263.2** rpm

PGT Diagram

Results

Limiting Data to search the tiple teeth set

Gear Ratio Tolerance (0.01 to 10 %)

Limit the Gears Teeth Quantity

Desired Teeth Interval:	Values Set:
Ring: <input type="text"/> to <input type="text"/>	36 to 250
Sun: <input type="text"/> to <input type="text"/>	12 to 226
Planets: <input type="text"/> to <input type="text"/>	12 to 119

The PGTs quantity that satisfies the conditions is: **5** Gear Ratio Interval (GR): **5.694 to 5.706**

Possible Solutions:

<input checked="" type="checkbox"/>	Zr = 61	Zs = 13	Zp = 24	GR = 5.692
<input type="checkbox"/>	Zr = 122	Zs = 26	Zp = 48	GR = 5.692
<input type="checkbox"/>	Zr = 155	Zs = 33	Zp = 61	GR = 5.697
<input type="checkbox"/>	Zr = 183	Zs = 39	Zp = 72	GR = 5.692
<input type="checkbox"/>	Zr = 216	Zs = 46	Zp = 85	GR = 5.696

Zr = 61 Zs = 13 Zp = 24 GR = 5.692

Exemplo 1 TEP: Síntese

Software TEPiciclo – Transmissão

1 PGT - Determination of the Kinematic Relation through the Gear Ratio

File Back Print Exit

Driving Data

1 PGT Torque Analysis

Close View Print

PGT Data

Teeth Quantity:

Ring: 61
Sun: 13
Planets: 24
Train Value: -0.213

OK Cancel

PGT Diagram

Results

Values as a function of τ_{in} :

τ_1 : 4.692 $\times \tau_{in}$
 τ_2 : -2.846 $\times \tau_{in}$
 τ_3 : -1.846 $\times \tau_{in}$
 τ_4 : -2.846 $\times \tau_{in}$
 τ_5 : 1.846 $\times \tau_{in}$
 τ_6 : 1.0 $\times \tau_{in}$
 τ_r : 4.692 $\times \tau_{in}$
 τ_{out} : 5.692 $\times \tau_{in}$

The calculated values are a function of the input Torque τ_{in} and the signals (+) or (-) indicate the Torque Flow Direction.

PGT Diagram

Values in modulus and as a function of τ_{in}

Component	Value
τ_1	4.69
τ_2	2.85
τ_3	1.85
τ_4	2.85
τ_5	1.85
τ_6	1.00
τ_r	4.69
τ_{out}	5.69

$Z_r = 183$ $Z_s = 39$ $Z_p = 72$ $GR = 5.692$
 $Z_r = 216$ $Z_s = 46$ $Z_p = 85$ $GR = 5.696$

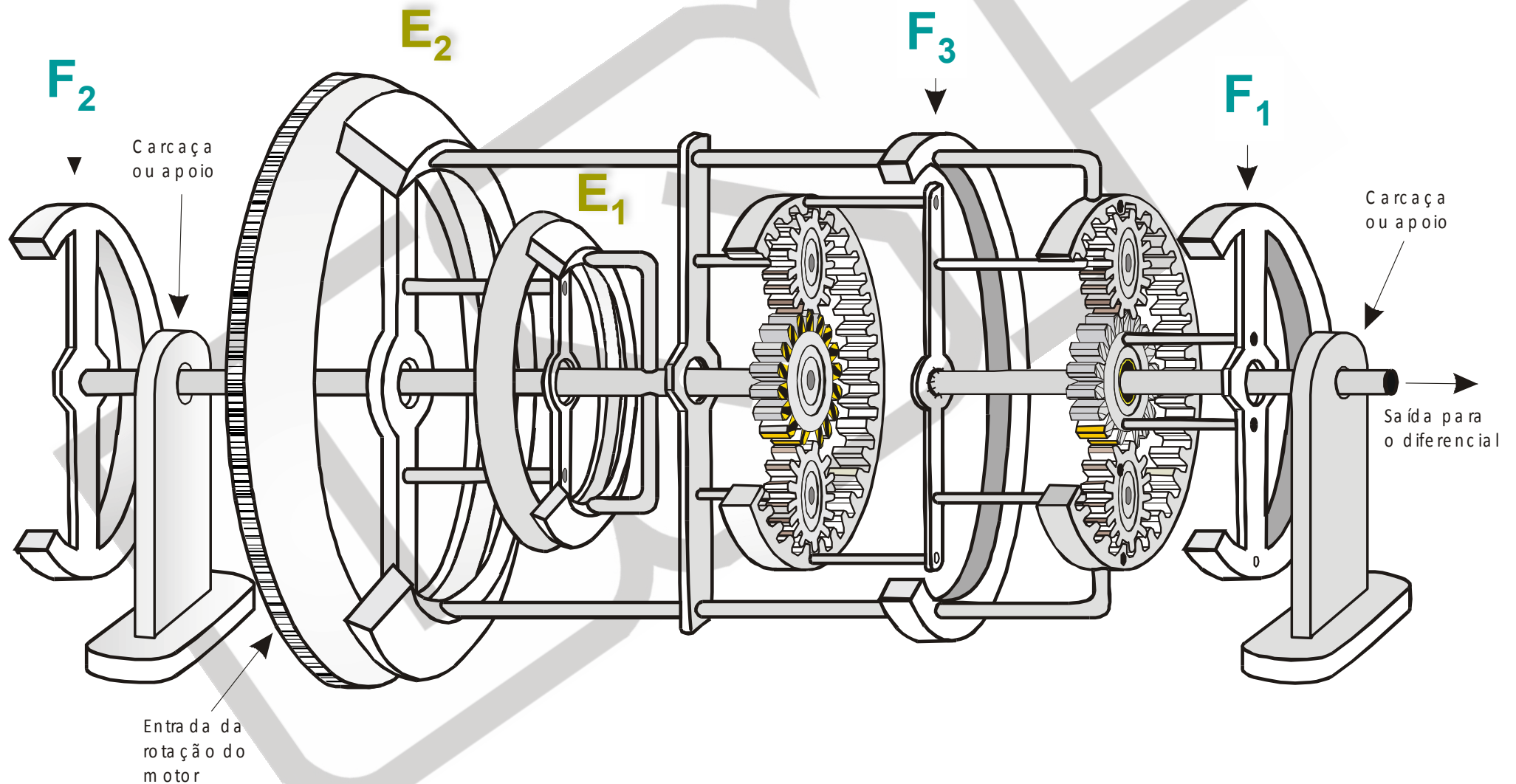
Torque Analysis

Sumário da Aula

- Software TEPiciclo
- Exemplo 1 TEP: Análise
- Exemplo 1 TEP: Síntese
- **Exemplo 2 TEPs: Análise**
- Exemplo 2 TEPs: Síntese

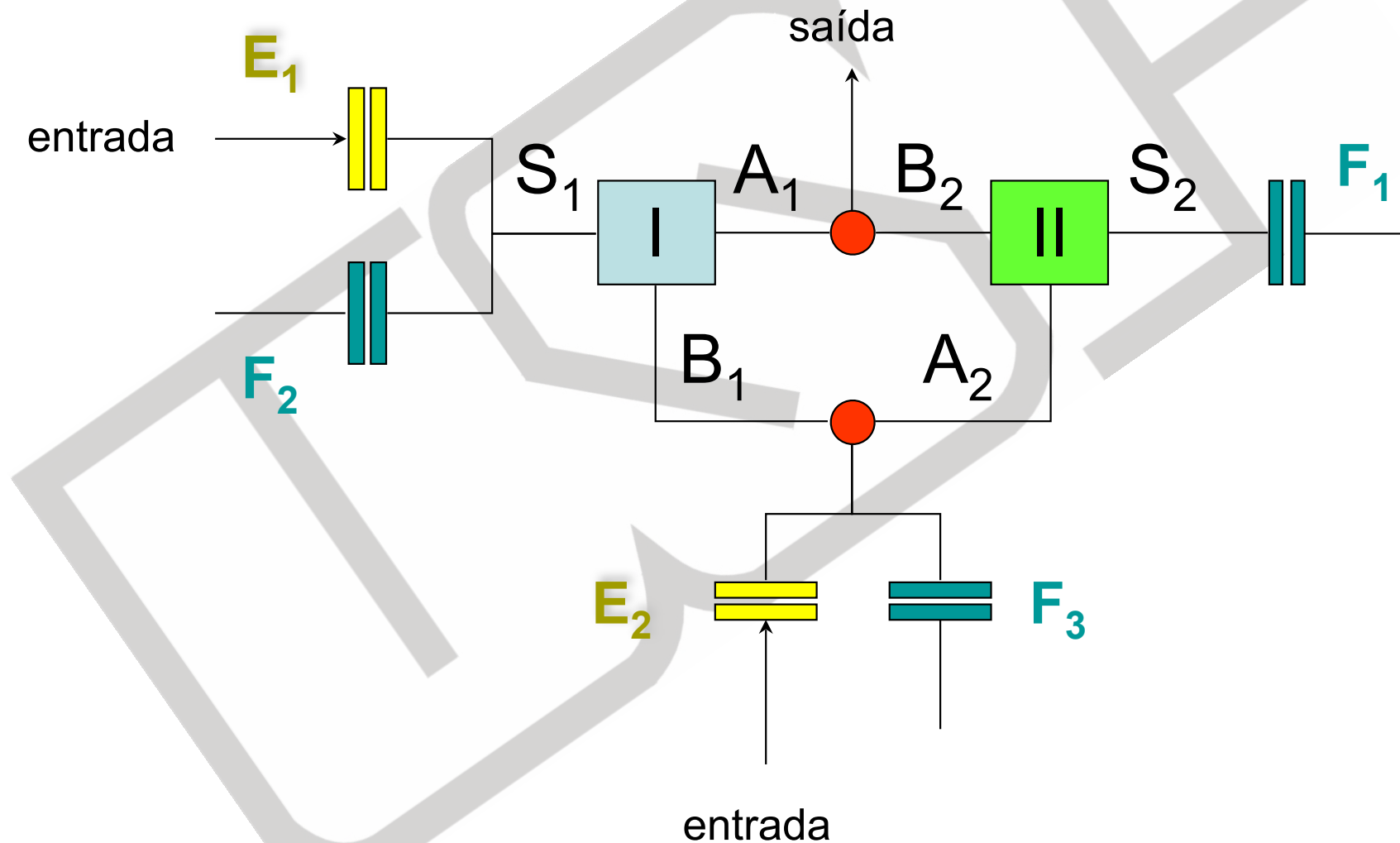
Transmissões Veiculares

Caixa GM HIDRA-MATIC THM – 440 PGT



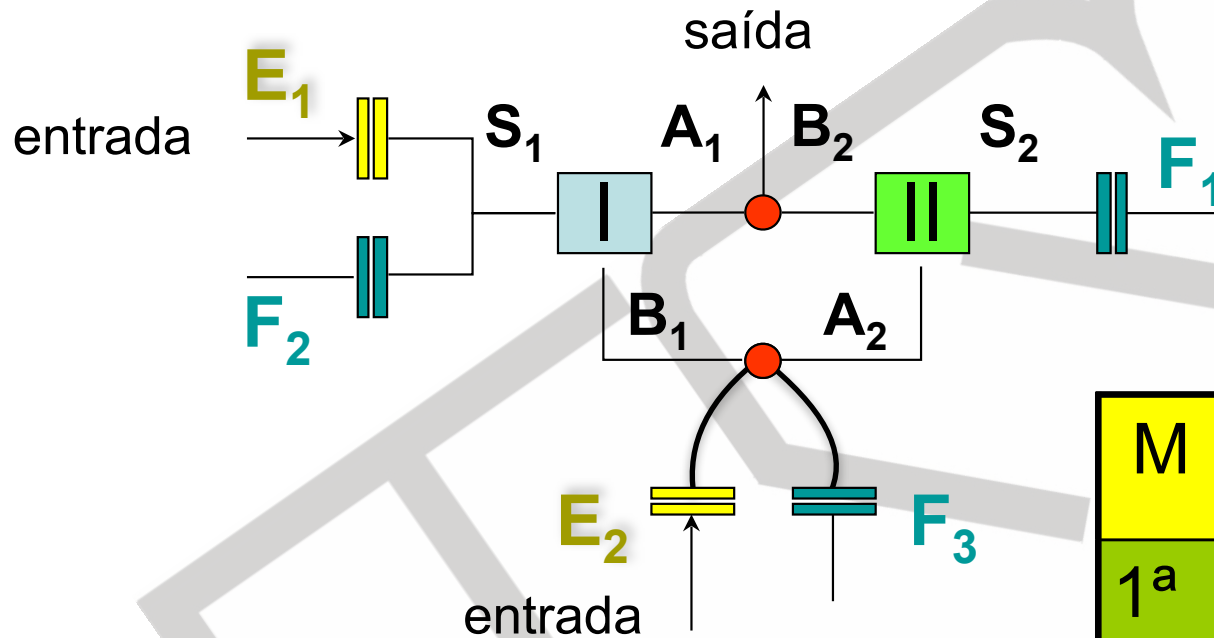
Transmissões Veiculares

Caixa GM HIDRA-MATIC THM – 440 PGT



Transmissões Veiculares

Caixa GM HIDRA-MATIC THM – 440 PGT



	Z_S	Z_P	Z_A
TEP I	26	18	62
TEP II	42	16	74

M	RT:1	E_1	E_2	F_1	F_2	F_3
1 ^a	2,92	X		X		
2 ^a	1,57		X	X		
3 ^a	1,00	X	X			
4 ^a	0,71		X		X	
ré	-2,38	X				X

Exemplo 2 TEPs: Análise

Software TEPiciclo – Número de Dentes

The screenshot displays the '2 PGTs - Determination of the Kinematic Relations through the Teeth Quantity' window. It is divided into two main sections: 'Gear Teeth Quantity' and 'PGTs Elements Position'.

Gear Teeth Quantity:

- PGT I:** Sun: 26, Planets: 18, Ring: 62. Calculated value: $b_I = -0.419$
- PGT II:** Sun: 42, Planets: 16, Ring: 74. Calculated value: $b_{II} = -0.568$

PGTs Elements Position:

The diagram shows two planetary gear trains (PGT I and PGT II) connected in series. PGT I is represented by a red box and PGT II by a green box. The diagram includes a legend for the elements:

- Ring
- Sun
- Arm

At the bottom of the window, there are control buttons: 'Confirm', 'Change PGT I', 'Change PGT II', and 'Cancel'.

Exemplo 2 TEPs: Análise

Software TEPiciclo – Número de Dentes

The screenshot displays the '2 PGTs - Determination of the Kinematic Relations through the Teeth Quantity' window. It is divided into two main sections: 'Gear Teeth Quantity' and 'PGTs Elements Position'.

Gear Teeth Quantity:

- PGT I:** Sun: 26, Planets: 18, Ring: 62. Calculated value: $bI = -0.419$
- PGT II:** Sun: 42, Planets: 16, Ring: 74. Calculated value: $bII = -0.568$

PGTs Elements Position:

The diagram shows two planetary gear trains (PGT I and PGT II) connected in series. PGT I is represented by a red box 'I' and PGT II by a green box 'II'. The Sun gear is labeled 'Sun' and is shown as a dashed box with a dot. The diagram includes labels for 'Ring' and 'Arm' gears. A vertical green line separates the two gear trains. The diagram is enclosed in a dashed red and green border.

Buttons at the bottom include: Confirm, Change PGT I, Change PGT II, Confirm, Change PGT I, Change PGT II, and Cancel.

Exemplo 2 TEPs: Análise

Software TEPiciclo – Número de Dentes

2 PGTs - Determination of the Kinematic Relations through the Teeth Quantity

File Back View Print Exit

Gear Teeth Quantity

PGT I

Sun:

Planets: $b_I = -0.419$

Ring:

PGT II

Sun:

Planets: $b_{II} = -0.568$

Ring:

PGTs Elements Position

Ring
 Sun
 Arm

Ring
 Sun
 Arm

Ring
 Sun
 Arm

Exemplo 2 TEPs: Análise

Software TEPiciclo – Número de Dentes

2 PGTs - Determination of the Kinematic Relations through the Teeth Quantity

File Back View Print Exit

Gear Teeth Quantity

PGT I

Sun:

Planets: $b_I = -0.419$

Ring:

PGT II

Sun:

Planets: $b_{II} = -0.568$

Ring:

PGTs Elements Position

Confirm Change PGT I Change PGT II Confirm Change PGT I Change PGT II Cancel

Exemplo 2 TEPs: Análise

Software TEPiciclo – Número de Dentes

2 PGTs - Determination of the Kinematic Relations through the Teeth Quantity

File Back View Print Exit

Gear Teeth Quantity

PGT I

Sun:

Planets: $b_I = -0.419$

Ring:

PGT II

Sun:

Planets: $b_{II} = -0.568$

Ring:

PGTs Elements Position

Confirm Change PGT I Change PGT II **Confirm** Change PGT I Change PGT II Cancel

Exemplo 2 TEPs: Análise

Software TEPiciclo – Número de Dentes

2 PGTs - Determination of the Kinematic Relations through the Teeth Quantity

File Back View Print Exit

Gear Teeth Quantity

PGT I

Sun: **bI = -0.419**

Planets:

Ring:

PGT II

Sun: **bII = -0.568**

Planets:

Ring:

PGTs Elements Position

Results - Assemblies and Possible Gear Ratios

A

1st	<input type="text" value="1.8645"/>	: 1
2nd	<input type="text" value="0.6378"/>	: 1
3rd	<input type="text" value="2.1567"/>	: 1
4th	<input type="text" value="1.4190"/>	: 1
5th	<input type="text" value="-1.7606"/>	: 1
6th	<input type="text" value="3.3866"/>	: 1
DD	<input type="text" value="1.0000"/>	: 1

B

1st	<input type="text" value="2.9236"/>	: 1
2nd	<input type="text" value="1.5680"/>	: 1
3rd	<input type="text" value="1.5199"/>	: 1
4th	<input type="text" value="0.7047"/>	: 1
5th	<input type="text" value="2.7606"/>	: 1
6th	<input type="text" value="-2.3866"/>	: 1
DD	<input type="text" value="1.0000"/>	: 1

C

1st	<input type="text" value="0.5363"/>	: 1
2nd	<input type="text" value="0.3420"/>	: 1
3rd	<input type="text" value="-1.1567"/>	: 1
4th	<input type="text" value="-0.4190"/>	: 1
5th	<input type="text" value="0.2953"/>	: 1
6th	<input type="text" value="-0.5199"/>	: 1
DD	<input type="text" value="1.0000"/>	: 1

D

1st	<input type="text" value="0.4637"/>	: 1
2nd	<input type="text" value="0.6580"/>	: 1
3rd	<input type="text" value="-0.8645"/>	: 1
4th	<input type="text" value="0.3622"/>	: 1
5th	<input type="text" value="-0.5680"/>	: 1
6th	<input type="text" value="-1.9236"/>	: 1
DD	<input type="text" value="1.0000"/>	: 1

Exemplo 2 TEPs: Análise

Software TEPiciclo – Número de Dentes

2 PGTs - Determination of the Kinematic Relations through the Teeth Quantity

File Back View Print Exit

Gear Teeth Quantity

PGT I

Sun: **bI = -0.419**

Planets:

Ring:

PGT II

Sun:

Planets: **bII = -0.568**

Ring:

PGTs Elements Position

Confirm Change PGT I Change PGT II Confirm Change PGT I Change PGT II Cancel

Results - Assemblies and Possible Gear Ratios

A

1st	1.8645	:1
2nd	0.6378	:1
3rd	2.1567	:1
4th	1.4190	:1
5th	-1.7606	:1
6th	3.3866	:1
DD	1.0000	:1

B

1st	2.9236	:1
2nd	1.5680	:1
3rd	1.5199	:1
4th	0.7047	:1
5th	2.7606	:1
6th	-2.3866	:1
DD	1.0000	:1

C

1st	0.5363	:1
2nd	0.3420	:1
3rd	-1.1567	:1
4th	-0.4190	:1
5th	0.2953	:1
6th	-0.5199	:1
DD	1.0000	:1

D

1st	0.4637	:1
2nd	0.6580	:1
3rd	-0.8645	:1
4th	0.3622	:1
5th	-0.5680	:1
6th	-1.9236	:1
DD	1.0000	:1

Torque Analysis

Change Assembly

Change Position

Change Teeth Quantity

Cancel

Exemplo 2 TEPs: Análise

Software TEPiciclo – Número de Dentes

2 PGTs - Determination of the Kinematic Relations through the Teeth Quantity

File Back View Print Exit

Gear Teeth Quantity

PGT I

Sun:

Planets: **bI = -0.419**

Ring:

PGT II

Sun:

Planets: **bII = -0.568**

Ring:

PGTs Elements Position

Results - Assemblies and Possible Gear Ratios

Assembly	1st	2nd	3rd	4th	5th	6th	DD
<input type="radio"/> A	1.8645 : 1	0.6378 : 1	2.1567 : 1	1.4190 : 1	-1.7606 : 1	3.3866 : 1	1.0000 : 1
<input checked="" type="radio"/> B	2.9236 : 1	1.5680 : 1	1.5199 : 1	0.7047 : 1	2.7606 : 1	-2.3866 : 1	1.0000 : 1
<input type="radio"/> C	0.5363 : 1	0.3420 : 1	-1.1567 : 1	-0.4190 : 1	0.2953 : 1	-0.5199 : 1	1.0000 : 1
<input type="radio"/> D	0.4637 : 1	0.6580 : 1	-0.8645 : 1	0.3622 : 1	-0.5680 : 1	-1.9236 : 1	1.0000 : 1

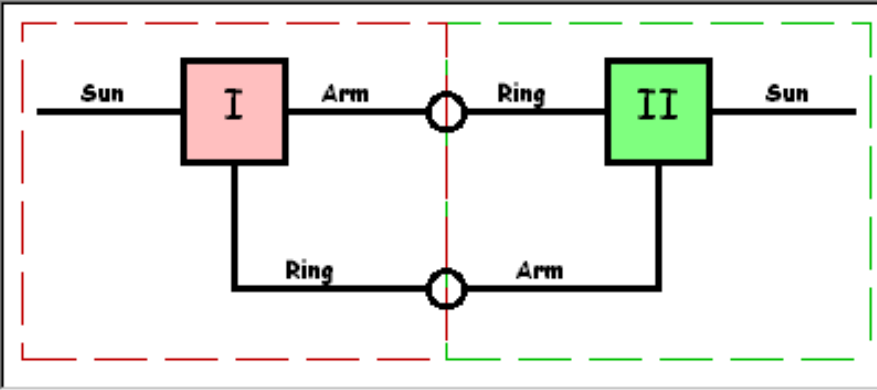
Exemplo 2 TEPs: Análise

Software TEPiciclo – Número de Dentes

Torque Analysis vs. Gear Ratio

Close View Print

Position



Teeth Quantity:

PST I

Sun: Ring: 62
Sun: 26
Planets: 18

PST II

Sun: Ring: 74
Sun: 42
Planets: 16

Select a Gear for the analysis:

1st 2.924 : 1 3rd 1.520 : 1 5th 2.761 : 1

2nd 1.568 : 1 4th 0.705 : 1 6th -2.387 : 1

Confirm Back

Cancel

Torque Analysis

Change assembly

Change position

Change Teeth Quantity

Cancel

4th	1.4190 : 1	4th	0.7047 : 1	4th	-0.4190 : 1	4th	0.3622 : 1
5th	-1.7606 : 1	5th	2.7606 : 1	5th	0.2953 : 1	5th	-0.5680 : 1
6th	3.3866 : 1	6th	-2.3866 : 1	6th	-0.5199 : 1	6th	-1.9236 : 1
DD	1.0000 : 1	DD	1.0000 : 1	DD	1.0000 : 1	DD	1.0000 : 1

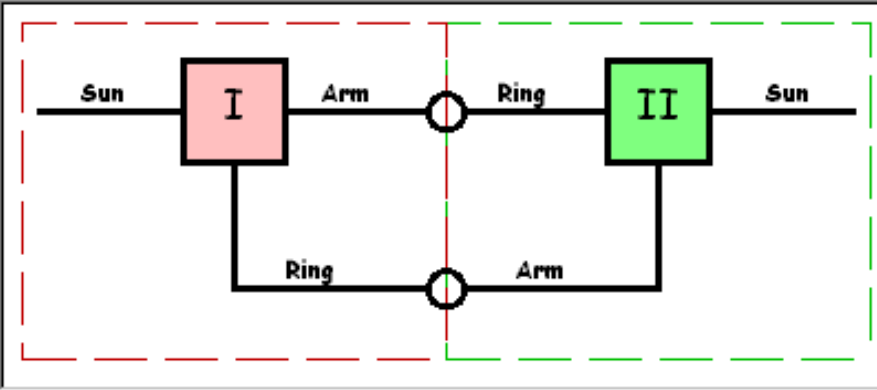
Exemplo 2 TEPs: Análise

Software TEPiciclo – Número de Dentes

Torque Analysis vs. Gear Ratio

Close View Print

Position



Teeth Quantity:

PST I

Sun: Ring: 62
Sun: 26
Planets: 18

PST II

Sun: Ring: 74
Sun: 42
Planets: 16

Select a Gear for the analysis:

1st 2.924 : 1 3rd 1.520 : 1 5th 2.761 : 1

2nd 1.568 : 1 4th 0.705 : 1 6th -2.387 : 1

Confirm Back

Cancel Torque Analysis Change assembly Change position Change Teeth Quantity Cancel

4th	1.4190 : 1	4th	0.7047 : 1	4th	-0.4190 : 1	4th	0.3622 : 1
5th	-1.7606 : 1	5th	2.7606 : 1	5th	0.2953 : 1	5th	-0.5680 : 1
6th	3.3866 : 1	6th	-2.3866 : 1	6th	-0.5199 : 1	6th	-1.9236 : 1
DD	1.0000 : 1	DD	1.0000 : 1	DD	1.0000 : 1	DD	1.0000 : 1

Exemplo 2 TEPs: Análise

Software TEPiciclo – Número de Dentes

Torque Analysis vs. Gear Ratio

Close View Print

PGT I
Teeth Quantity:
Ring: 62
Sun: 26
Planets: 18

PGT II
Teeth Quantity:
Ring: 74
Sun: 42
Planets: 16

Confirm
Back

PGT Assembly

Results (in modulus) for the 1st Gear Ratio

Values in modulus and as a function of τ_{in}

PGT I

τ_1 τ_2 τ_3 τ_4 τ_5 τ_6 $\times \tau_{in}$

2.38 1.69 0.69 0.69 1.69 1.00

PGT I **PGT II**

Results for PGT I.

Values in modulus and as a function of τ_{in}

PGT II

τ_7 τ_8 τ_9 τ_{10} τ_{11} τ_{12} $\times \tau_{in}$

3.38 0.73 2.65 0.73 2.65 1.92

Fixed and Output Elements

τ_r τ_{out} $\times \tau_{in}$

1.92 2.92

Results for PGT II.

Values as a function of τ_{in} :

τ_1 : 2.385 $\times \tau_{in}$
 τ_2 : -1.692 $\times \tau_{in}$
 τ_3 : -0.692 $\times \tau_{in}$
 τ_4 : 0.692 $\times \tau_{in}$
 τ_5 : -1.692 $\times \tau_{in}$
 τ_6 : 1.0 $\times \tau_{in}$
 τ_7 : 3.385 $\times \tau_{in}$
 τ_8 : -0.732 $\times \tau_{in}$
 τ_9 : -2.653 $\times \tau_{in}$
 τ_{10} : 0.732 $\times \tau_{in}$
 τ_{11} : -2.653 $\times \tau_{in}$
 τ_{12} : 1.921 $\times \tau_{in}$
 τ_r : 1.921 $\times \tau_{in}$
 τ_{out} : 2.921 $\times \tau_{in}$

5th	-1.7606	:1	5th	2.7606	:1	5th	0.2953	:1	5th	-0.5680	:1	Teeth Quantity Cancel
6th	3.3866	:1	6th	-2.3866	:1	6th	-0.5199	:1	6th	-1.9236	:1	
DD	1.0000	:1	DD	1.0000	:1	DD	1.0000	:1	DD	1.0000	:1	

Exemplo 2 TEPs: Análise

Software TEPiciclo – Número de Dentes

2 P
Torque Analysis vs. Gear Ratio

Close View Print

PGT I
Teeth Quantity:
Ring: 62
Sun: 26
Planets: 18

PGT II
Teeth Quantity:
Ring: 74
Sun: 42
Planets: 16

Confirm
Back

PGT Assembly

Results (in modulus) for the 1st Gear Ratio

Values in modulus and as a function of τ_{in} PGT I

τ_1	τ_2	τ_3	τ_4	τ_5	τ_6
2.38	1.69	0.69	0.69	1.69	1.00

PGT I

PGT II

Values as a function of τ_{in}

τ_1	τ_2	τ_3	τ_4	τ_5	τ_6	τ_7	τ_8	τ_9	τ_{10}	τ_{11}	τ_{12}	τ_r	τ_{out}
$2.385 \times \tau_{in}$	$-1.692 \times \tau_{in}$	$-0.692 \times \tau_{in}$	$0.692 \times \tau_{in}$	$-1.692 \times \tau_{in}$	$1.0 \times \tau_{in}$	$3.385 \times \tau_{in}$	$-0.732 \times \tau_{in}$	$-2.653 \times \tau_{in}$	$0.732 \times \tau_{in}$	$-2.653 \times \tau_{in}$	$1.921 \times \tau_{in}$	$1.921 \times \tau_{in}$	$2.921 \times \tau_{in}$

Results for PGT I.

Values in modulus and as a function of τ_{in} PGT II

τ_7	τ_8	τ_9	τ_{10}	τ_{11}	τ_{12}
3.38	0.73	2.65	0.73	2.65	1.92

Fixed and Output Elements

τ_r	τ_{out}
1.92	2.92

Results for PGT II.

5th	-1.7606	:1	5th	2.7606	:1	5th	0.2953	:1	5th	-0.5680	:1	Teeth Quantity	
6th	3.3866	:1	6th	-2.3866	:1	6th	-0.5199	:1	6th	-1.9236	:1		Cancel
DD	1.0000	:1	DD	1.0000	:1	DD	1.0000	:1	DD	1.0000	:1		

Exemplo 2 TEPs: Análise

Software TEPiciclo – Número de Dentes

Torque Analysis vs. Gear Ratio

Close View Print

P&T I
Teeth Quantity:
Ring: 62
Sun: 26
Planets: 18

P&T II
Teeth Quantity:
Ring: 74
Sun: 42
Planets: 16

Confirm
Back

Resulting Chart for the 6 Gears

	τ_1	τ_2	τ_3	τ_4	τ_5	τ_6	τ_7	τ_8	τ_9	τ_{10}	τ_{11}	τ_{12}
1st 2.924 : 1	2.385	1.692	0.692	0.692	1.692	1.0	3.385	0.732	2.653	0.732	2.653	1.921
2nd 1.568 : 1	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.216	0.784	0.216	0.784	0.568
3rd 1.520 : 1	1.241	0.881	0.36	0.36	0.881	0.521	1.762	0.381	1.381	0.381	1.381	1.0
4th 0.705 : 1	0.705	0.5	0.205	0.205	0.5	0.295	0.0	0.0	0.0	0.0	0.0	0.0
5th 2.761 : 1	0.0	0.0	0.0	0.0	0.0	0.0	1.762	0.381	1.381	0.381	1.381	1.0
6th -2.387 : 1	2.385	1.692	0.692	0.692	1.692	1.0	0.0	0.0	0.0	0.0	0.0	0.0

The values are a function of τ_{in} .

	1st	2nd	3rd	4th	5th	6th
τ_{in}	1.921	0.568	0.521	0.295	1.762	3.385
τ_{out}	2.921	1.568	1.521	0.705	2.762	2.385

5th	-1.7606	:1	5th	2.7606	:1	5th	0.2953	:1	5th	-0.5680	:1	Teeth Quantity Cancel
6th	3.3866	:1	6th	-2.3866	:1	6th	-0.5199	:1	6th	-1.9236	:1	
DD	1.0000	:1	DD	1.0000	:1	DD	1.0000	:1	DD	1.0000	:1	

Exemplo 2 TEPs: Análise

Software TEPiciclo – Número de Dentes

2 P
Torque Analysis vs. Gear Ratio

Close View Print

P&G I
Teeth Quantity:
Ring
Sun
Planets

P&G II
Teeth Quantity:
Ring
Sun
Planets

Confirm
Back

Resulting Chart for the 6 Gears

	τ_1	τ_2	τ_3	τ_4	τ_5	τ_6	τ_7	τ_8	τ_9	τ_{10}	τ_{11}	τ_{12}
1st 2.924 : 1	2.385	1.692	0.692	0.692	1.692	1.0	3.385	0.732	2.653	0.732	2.653	1.921
2nd 1.568 : 1	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.216	0.784	0.216	0.784	0.568
3rd 1.520 : 1	1.241	0.881	0.36	0.36	0.881	0.521	1.762	0.381	1.381	0.381	1.381	1.0
4th 0.705 : 1	0.705	0.5	0.205	0.205	0.5	0.295	0.0	0.0	0.0	0.0	0.0	0.0
5th 2.761 : 1	0.0	0.0	0.0	0.0	0.0	0.0	1.762	0.381	1.381	0.381	1.381	1.0
6th -2.387 : 1	2.385	1.692	0.692	0.692	1.692	1.0	0.0	0.0	0.0	0.0	0.0	0.0

The values are a function of τ_{in} .

	1st	2nd	3rd	4th	5th	6th
τ_{in}	1.921	0.568	0.521	0.295	1.762	3.385
τ_{out}	2.921	1.568	1.521	0.705	2.762	2.385

5th	<input type="text" value="-1.7606"/>	: 1	5th	<input type="text" value="2.7606"/>	: 1	5th	<input type="text" value="0.2953"/>	: 1	5th	<input type="text" value="-0.5680"/>	: 1	Teeth Quantity Cancel
6th	<input type="text" value="3.3866"/>	: 1	6th	<input type="text" value="-2.3866"/>	: 1	6th	<input type="text" value="-0.5199"/>	: 1	6th	<input type="text" value="-1.9236"/>	: 1	
DD	<input type="text" value="1.0000"/>	: 1	DD	<input type="text" value="1.0000"/>	: 1	DD	<input type="text" value="1.0000"/>	: 1	DD	<input type="text" value="1.0000"/>	: 1	

Exemplo 2 TEPs: Análise

Software TEPiciclo – Número de Dentes

"Map" of the Results

	1'				2'				3'				4'				5'				6'				
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
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4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
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	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6

Caption:

- 1st Gear
- 2nd Gear
- 3rd Gear
- 4th Gear
- 5th Gear
- 6th Gear

Train Value:

b_I :

b_{II} :

Tolerance:

Gear Values:

1st: 2.923 ~ 2.924

2nd: 1.568 ~ 1.568

3rd: 1.52 ~ 1.52

4th: 0.705 ~ 0.705

5th: 2.76 ~ 2.761

6th: -2.387 ~ -2.386

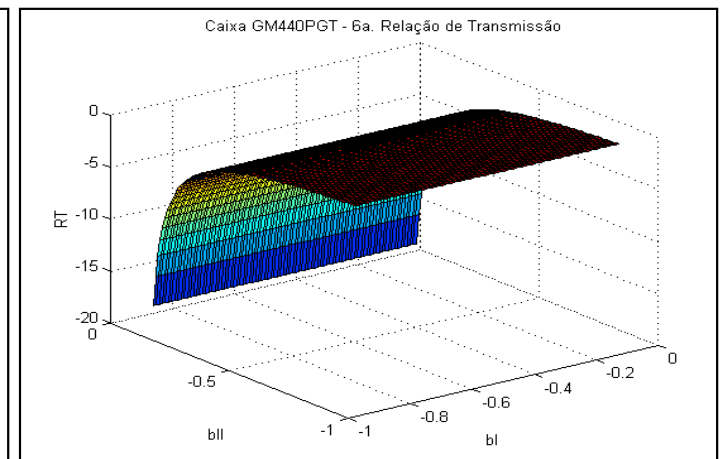
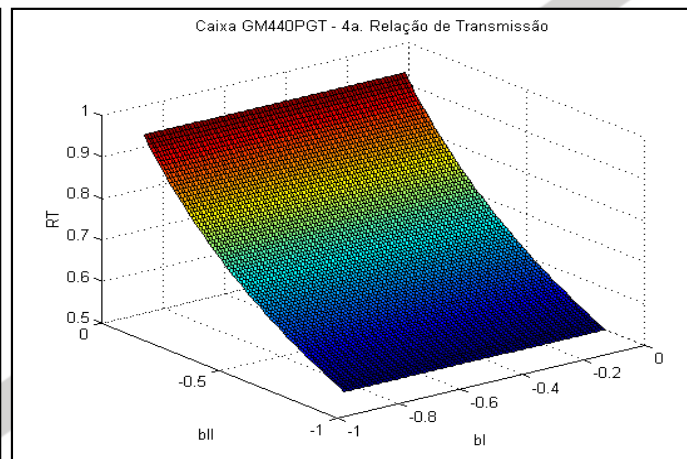
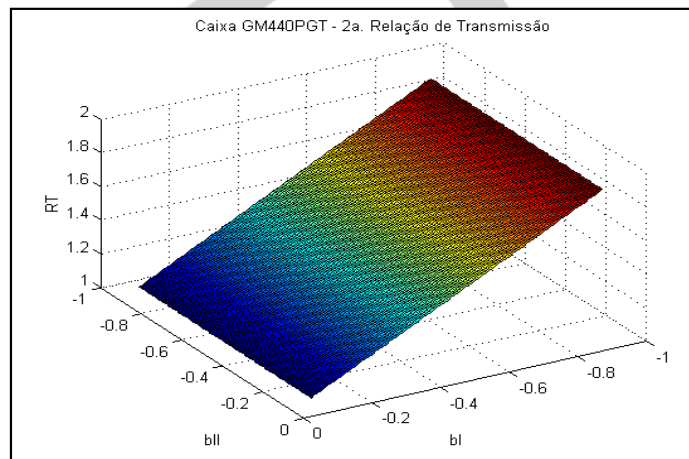
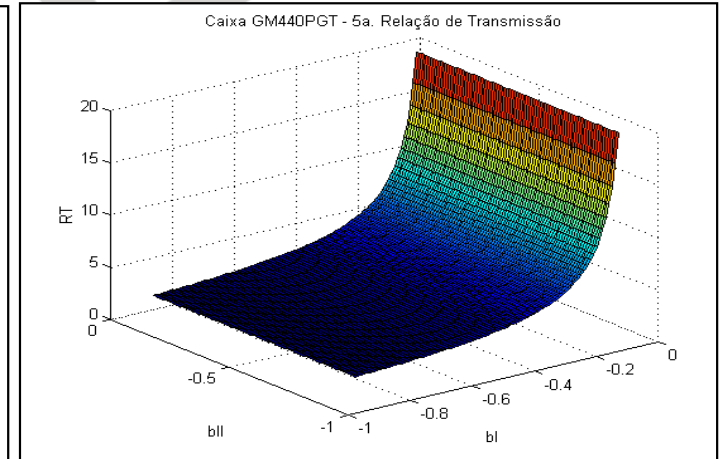
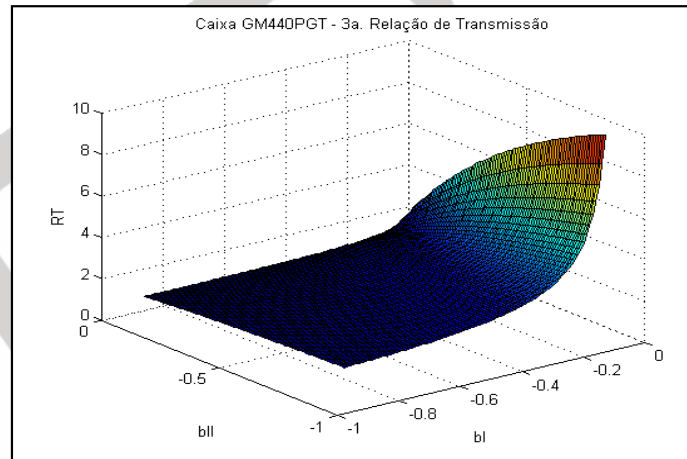
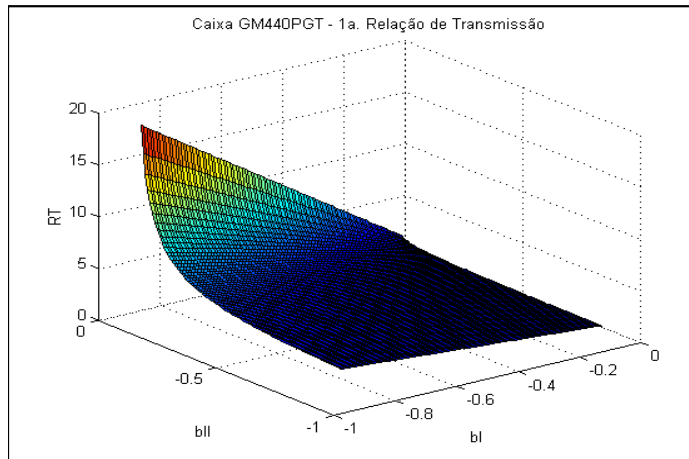
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Exemplo 2 TEPs: Análise

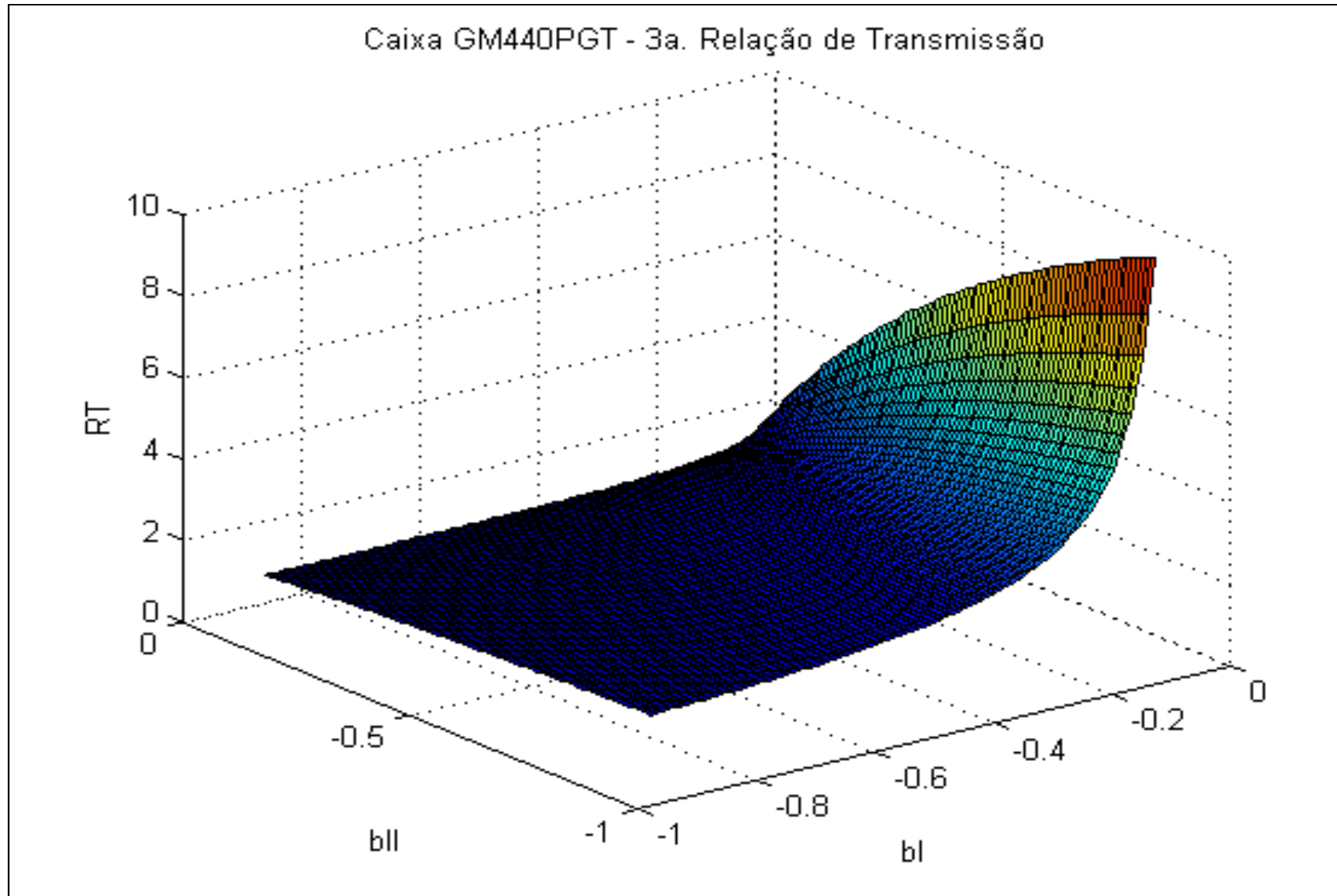
Caixa GM HIDRA-MATIC THM – 440 PGT

Gráficos 3D: b_I x b_{II} x RT



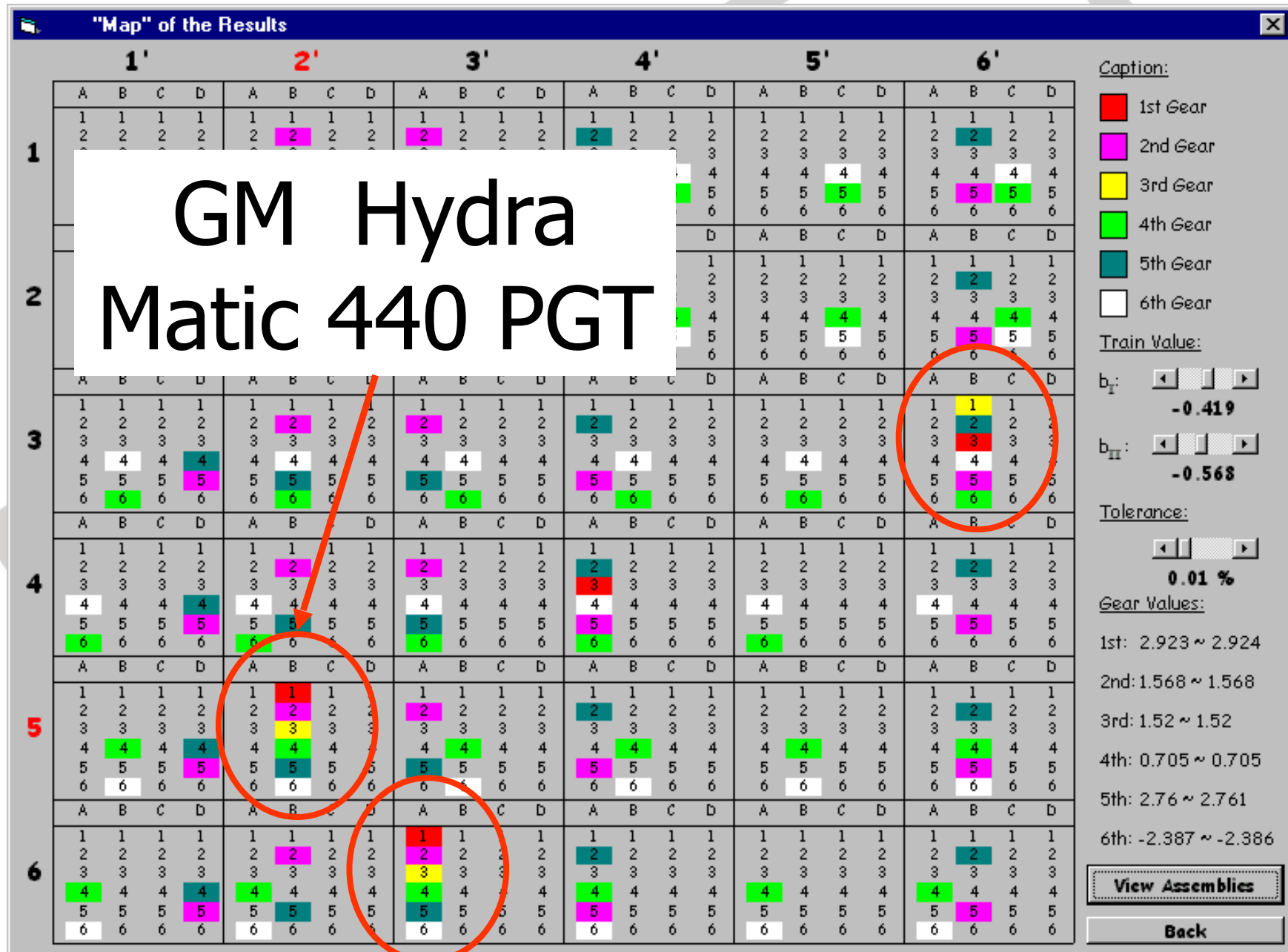
Exemplo 2 TEPs: Análise

Software TEPiciclo – Transmissão



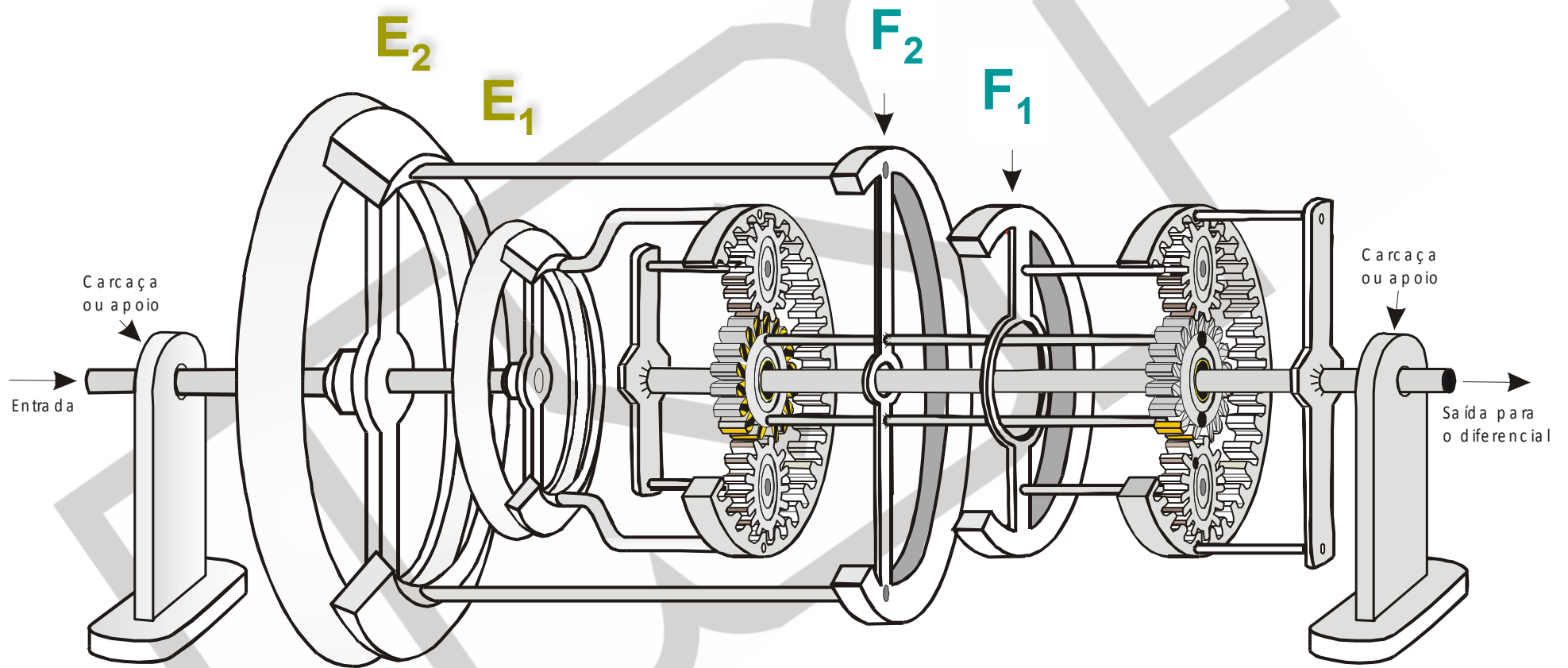
Exemplo 2 TEPs: Análise

Software TEPiciclo – Número de Dentes



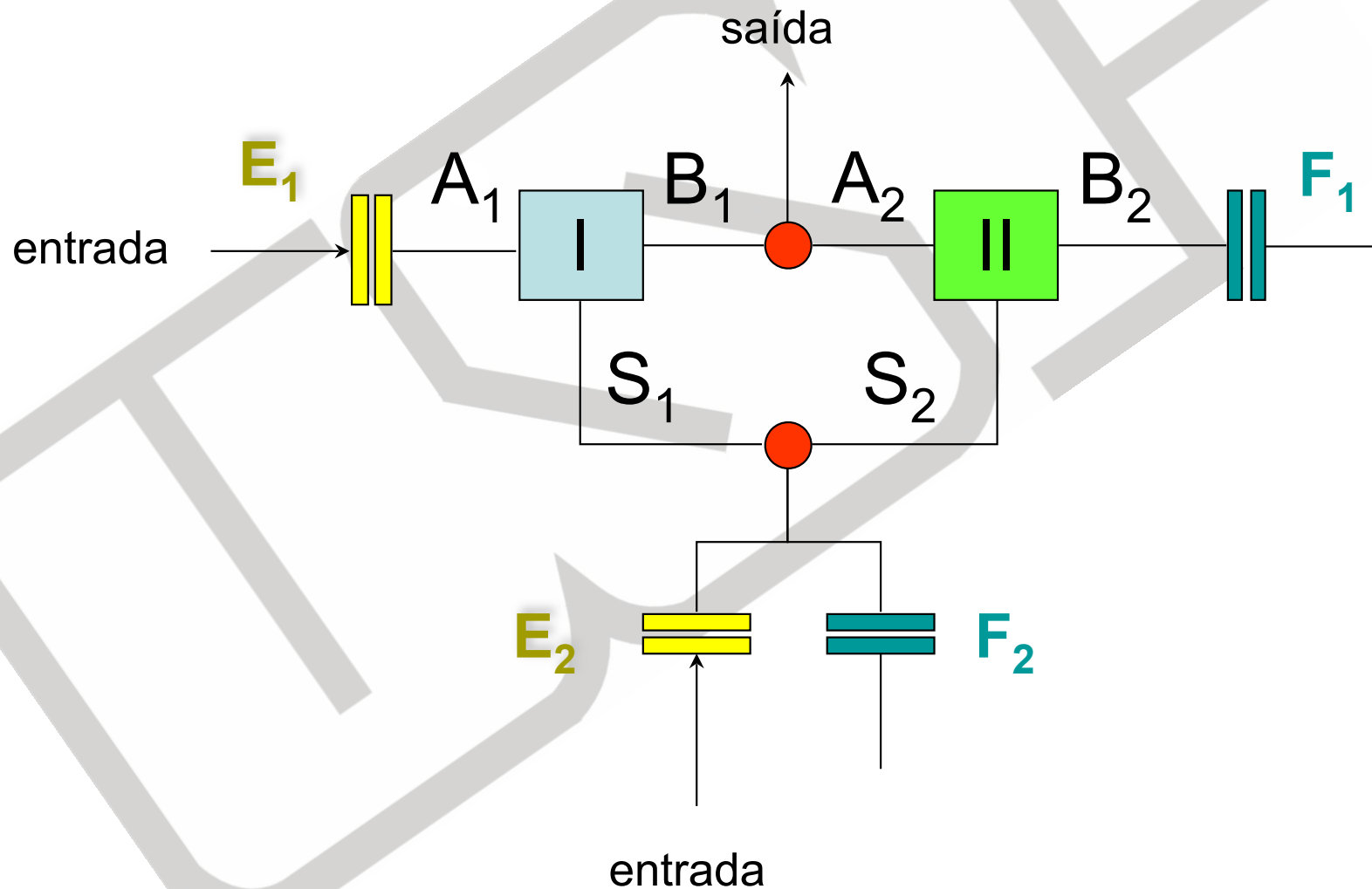
Transmissões Veiculares

Caixa Simpson



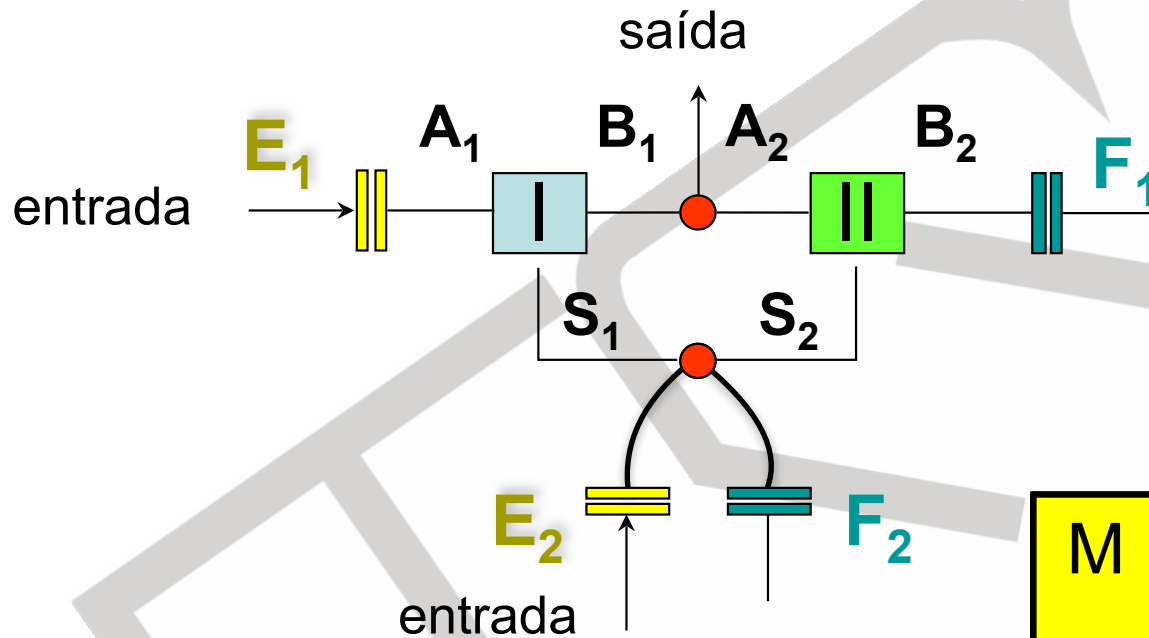
Transmissões Veiculares

Caixa Simpson



Transmissões Veiculares

Caixa Simpson



	Z_S	Z_P	Z_A
TEP I	36	16	68
TEP II	32	22	76

M	RT:1	E_1	E_2	F_1	F_2
1 ^a	2,79	X		X	
2 ^a	1,53	X			X
3 ^a	1,00	X	X		
ré	-2,38		X	X	

Exemplo 2 TEPs: Análise

Software TEPiciclo – Número de Dentes

"Map" of the Results

	1'				2'				3'				4'				5'				6'			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
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	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
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	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6

Caption:

- 1st Gear
- 2nd Gear
- 3rd Gear
- 4th Gear
- 5th Gear
- 6th Gear

Train Value:

b_I :

b_{II} :

Tolerance:

Gear Values:

1st: 2.784 ~ 2.79

2nd: -2.378 ~ -2.372

3rd: 1.558 ~ 1.561

4th: 2.886 ~ 2.892

5th: 0.703 ~ 0.704

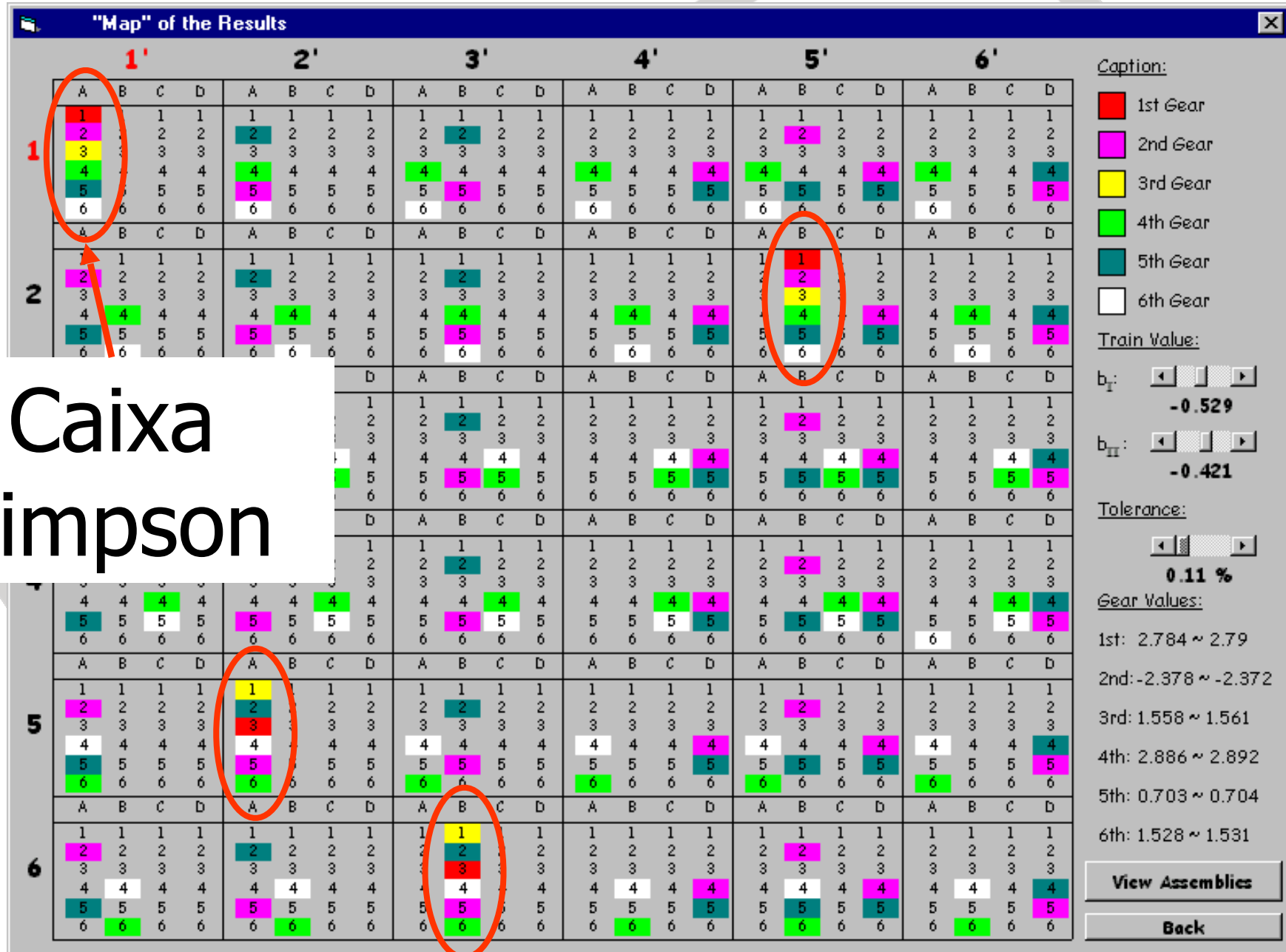
6th: 1.528 ~ 1.531

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Exemplo 2 TEPs: Análise

Software TEPiciclo – Número de Dentes



Sumário da Aula

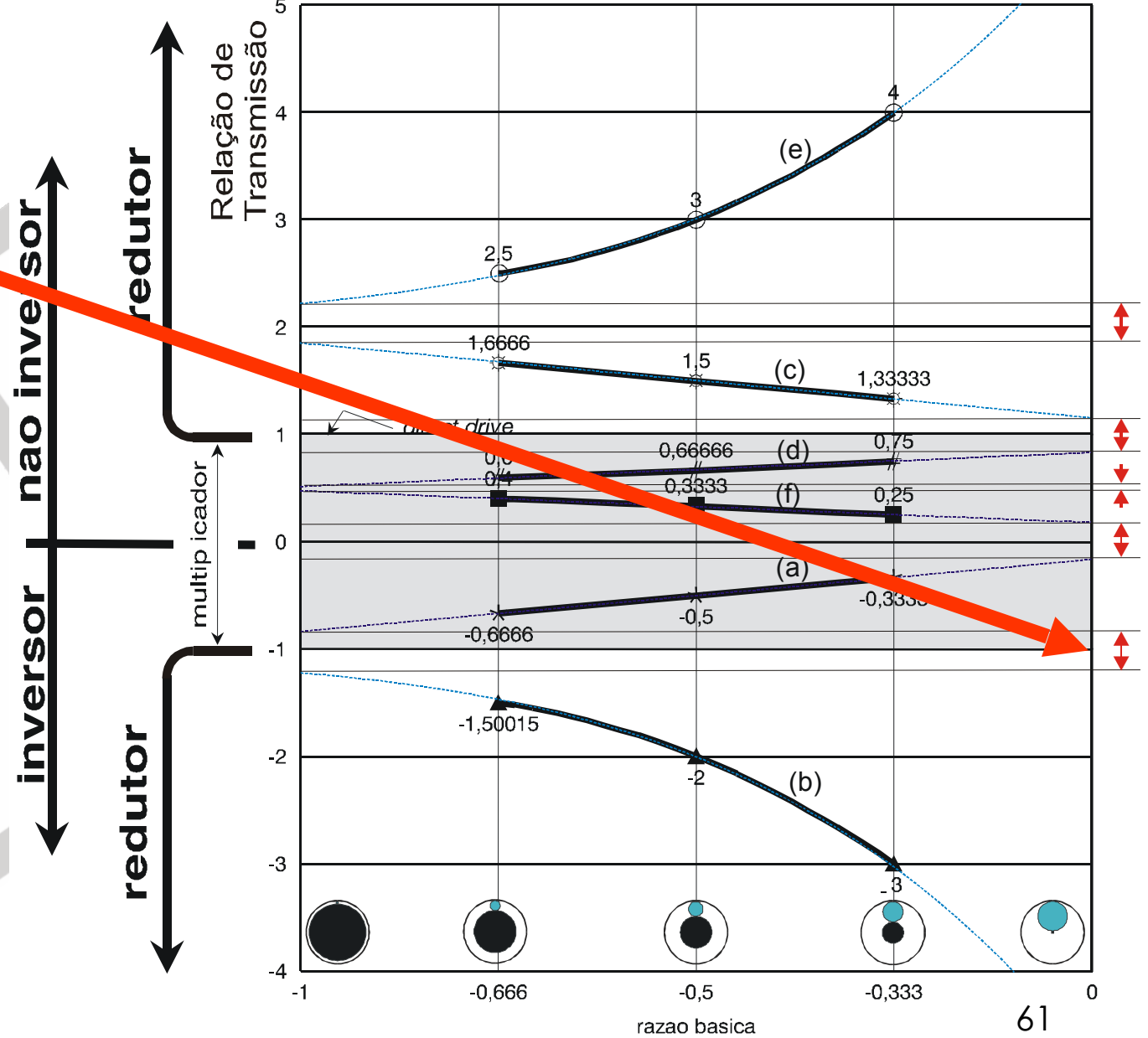
- Software TEPiciclo
- Exemplo 1 TEP: Análise
- Exemplo 1 TEP: Síntese
- Exemplo 2 TEPs: Análise
- **Exemplo 2 TEPs: Síntese**

Exemplo 2 TEPs: Síntese

Software TEPiciclo – Transmissão

$[-1.105; -0.905]$

RT = -1 : 1



Exemplo 2 TEPs: Síntese

Software TEPiciclo – Transmissão

2 PGTs - Determination of the Kinematic Relations through the Gear Ratios

File Back Change View Print Samples Exit

Gear Ratios

Gear Ratio Quantity (1 to 6)

Tolerance (0.01 to 10) %

Gear Ratios: : 1 Tolerance Set:

Limit the search to specific Positions between 2 PGTs

Limit the Train Values interval (bI and bII) standard interval: -0.904 to -0.048

bI to bII to

Limit the Teeth Quantity of the Gears

Gears Teeth Quantity

	Interval:	Values Set:
Ring:	<input type="text"/> to <input type="text"/>	36 to 250
Sun:	<input type="text"/> to <input type="text"/>	12 to 226
Planets:	<input type="text"/> to <input type="text"/>	12 to 119

Attention: It is not necessary to select the "Direct Drive" (1:1).

Exemplo 2 TEPs: Síntese

Software TEPiciclo – Transmissão

2 PGTs - Determination of the Kinematic Relations through the Gear Ratios

File Back Change View Print Samples Exit

Gear Ratios

Gear Ratio Quantity (1 to 6)

Tolerance (0.01 to 10) %

Limit the search to specific Positions between 2 PGTs

Limit the Train Values interval (bI and bII) standard interval: -0.904 to -0.048

bI to bII to

Limit the Teeth Quantity of the Gears

Gears Teeth Quantity

	Interval:	Values Set:
Ring:	<input type="text"/> to <input type="text"/>	36 to 250
Sun:	<input type="text"/> to <input type="text"/>	12 to 226
Planets:	<input type="text"/> to <input type="text"/>	12 to 119

Attention: It is not necessary to select the "Direct Drive" (1:1).

Exemplo 2 TEPs: Síntese

Software TEPiciclo – Transmissão

Back Exit

	1'	2'	3'	4'	5'	6'
1	 <input checked="" type="checkbox"/> Position 1	 <input type="checkbox"/> Position 2	 <input type="checkbox"/> Position 3	 <input type="checkbox"/> Position 4	 <input type="checkbox"/> Position 5	 <input type="checkbox"/> Position 6
2	 <input type="checkbox"/> Position 7	 <input type="checkbox"/> Position 8	 <input type="checkbox"/> Position 9	 <input type="checkbox"/> Position 10	 <input type="checkbox"/> Position 11	 <input type="checkbox"/> Position 12
3	 <input type="checkbox"/> Position 13	 <input type="checkbox"/> Position 14	 <input type="checkbox"/> Position 15	 <input type="checkbox"/> Position 16	 <input type="checkbox"/> Position 17	 <input type="checkbox"/> Position 18
4	 <input type="checkbox"/> Position 19	 <input type="checkbox"/> Position 20	 <input type="checkbox"/> Position 21	 <input type="checkbox"/> Position 22	 <input type="checkbox"/> Position 23	 <input type="checkbox"/> Position 24
5	 <input type="checkbox"/> Position 25	 <input type="checkbox"/> Position 26	 <input type="checkbox"/> Position 27	 <input type="checkbox"/> Position 28	 <input type="checkbox"/> Position 29	 <input type="checkbox"/> Position 30
6	 <input type="checkbox"/> Position 31	 <input type="checkbox"/> Position 32	 <input type="checkbox"/> Position 33	 <input type="checkbox"/> Position 34	 <input type="checkbox"/> Position 35	 <input type="checkbox"/> Position 36

Exemplo 2 TEPs: Síntese

Software TEPiciclo – Transmissão

The screenshot displays the TEPiciclo software interface for transmission synthesis. It features a grid of 36 configurations, organized into 6 rows and 6 columns. Each configuration is labeled with a row number (1-6) and a column number (1'-6'). Each configuration consists of a schematic diagram and a checkbox label. The first configuration, Position 1, is highlighted with a red circle and a red box around its label. The schematic diagrams show a network of nodes (R, A, S) connected by lines, representing different transmission topologies.

	1'	2'	3'	4'	5'	6'
1	<input checked="" type="checkbox"/> Position 1	<input type="checkbox"/> Position 2	<input type="checkbox"/> Position 3	<input type="checkbox"/> Position 4	<input type="checkbox"/> Position 5	<input type="checkbox"/> Position 6
2	<input type="checkbox"/> Position 7	<input type="checkbox"/> Position 8	<input type="checkbox"/> Position 9	<input type="checkbox"/> Position 10	<input type="checkbox"/> Position 11	<input type="checkbox"/> Position 12
3	<input type="checkbox"/> Position 13	<input type="checkbox"/> Position 14	<input type="checkbox"/> Position 15	<input type="checkbox"/> Position 16	<input type="checkbox"/> Position 17	<input type="checkbox"/> Position 18
4	<input type="checkbox"/> Position 19	<input type="checkbox"/> Position 20	<input type="checkbox"/> Position 21	<input type="checkbox"/> Position 22	<input type="checkbox"/> Position 23	<input type="checkbox"/> Position 24
5	<input type="checkbox"/> Position 25	<input type="checkbox"/> Position 26	<input type="checkbox"/> Position 27	<input type="checkbox"/> Position 28	<input type="checkbox"/> Position 29	<input type="checkbox"/> Position 30
6	<input type="checkbox"/> Position 31	<input type="checkbox"/> Position 32	<input type="checkbox"/> Position 33	<input type="checkbox"/> Position 34	<input type="checkbox"/> Position 35	<input type="checkbox"/> Position 36

Exemplo 2 TEPs: Síntese

Software TEPiciclo – Transmissão

2 PGTs - Determination of the Kinematic Relations through the Gear Ratios

File Back Change View Print Samples Exit

Gear Ratios

Gear Ratio Quantity (1 to 6) Tolerance (0.01 to 10) %

Gear Ratios: Tolerance Set:

: 1 ~

Limit the search to specific Positions between 2 PGTs

Limit the Train Values interval (bI and bII) standard interval: -0.904 to -0.048

bI to bII to

Limit the Teeth Quantity of the Gears

Gears Teeth Quantity

Interval: Values Set:


Ring: to 36 to 250

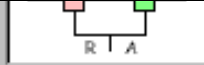
Sun: to 12 to 226

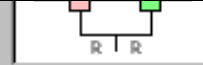
Planets: to 12 to 119

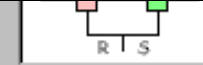
Attention: It is not necessary to select the "Direct Drive" (1:1).

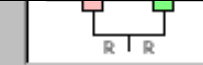
5

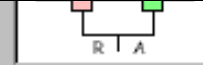
 Position 25

 Position 26

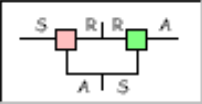
 Position 27

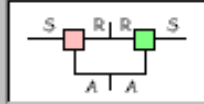
 Position 28

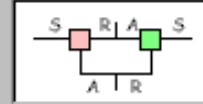
 Position 29

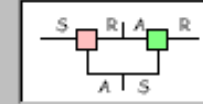
 Position 30

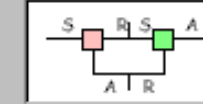
6

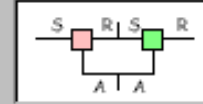
 Position 31

 Position 32

 Position 33

 Position 34

 Position 35

 Position 36

Confirm

Cancel

Exemplo 2 TEPs: Síntese

Software TEPiciclo – Transmissão

2 PGTs - Determination of the Kinematic Relations through the Gear Ratios

File Back Change View Print Samples Exit

Gear Ratios

Gear Ratio Quantity (1 to 6) Tolerance (0.01 to 10) %

Gear Ratios: Tolerance Set:

: 1 ~

Limit the search to specific Positions between 2 PGTs

Limit the Train Values interval (bI and bII) standard interval: -0.904 to -0.048

bI to bII to

Limit the Teeth Quantity of the Gears

Gears Teeth Quantity

Interval: Values Set:


Ring: to 36 to 250

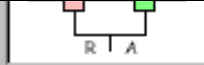
Sun: to 12 to 226

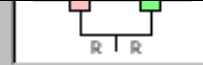
Planets: to 12 to 119

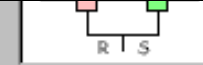
Attention: It is not necessary to select the "Direct Drive" (1:1).

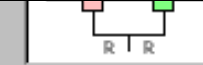
5

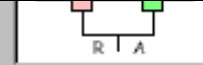
 Position 25

 Position 26

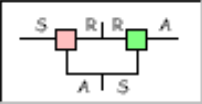
 Position 27

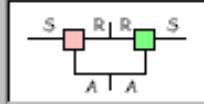
 Position 28

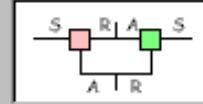
 Position 29

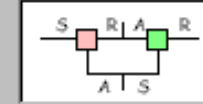
 Position 30

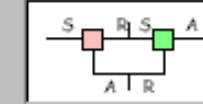
6

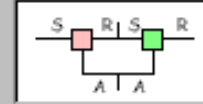
 Position 31

 Position 32

 Position 33

 Position 34

 Position 35

 Position 36

Confirm

Cancel

Exemplo 2 TEPs: Síntese

Software TEPiciclo – Transmissão

2 PGTs - Determination of the Kinematic Relations through the Gear Ratios

File Back Change View Print Samples Exit

Gear Ratios

Gear Ratio Quantity (1 to 6) Tolerance (0.01 to 10) %

Gear Ratios: Tolerance Set:

: 1 ~

Limit the search to specific Positions between 2 PGTs

Limit the Train Values interval (bI and bII) standard interval: -0.904 to -0.048

bI to bII to

Limit the Teeth Quantity of the Gears

Gears Teeth Quantity

	Interval:	Values Set:
Ring:	<input type="text"/> to <input type="text"/>	36 to 250
Sun:	<input type="text"/> to <input type="text"/>	12 to 226
Planets:	<input type="text"/> to <input type="text"/>	12 to 119

Searching Time
1 min 2 sec

Attention: It is not necessary to select the "Direct Drive" (1:1).

Results

The quantity of possible combinations of 2 PGTs that satisfy the conditions is: **100**

Possible Solutions:

<input type="checkbox"/>	bI = - 0.497	bII = - 0.336	Position 1 (1-1')	Assembly B
<input type="checkbox"/>	bI = - 0.497	bII = - 0.336	Position 1 (1-1')	Assembly C
<input type="checkbox"/>	bI = - 0.487	bII = - 0.345	Position 1 (1-1')	Assembly B
<input type="checkbox"/>	bI = - 0.487	bII = - 0.345	Position 1 (1-1')	Assembly C

Exemplo 2 TEPs: Síntese

Software TEPiciclo – Transmissão

The screenshot shows the '2 PGTs - Determination of the Kinematic Relations through the Gear Ratios' window. The 'View' menu item is circled in red. The 'Gear Ratios' section includes a 'Gear Ratio Quantity' of 1, a 'Tolerance' of 0.01%, and a 'Gear Ratios' list containing '-1 : 1 -1.0001 ~ -0.9999'. The 'Limit the search to specific Positions between 2 PGTs' and 'Limit the Train Values interval' options are checked. The 'Train Values interval' is set to bI: -0.904 to -0.333 and bII: -0.904 to -0.333. The 'Limit the Teeth Quantity of the Gears' option is unchecked. The 'Gears Teeth Quantity' section shows intervals for Ring, Sun, and Planets. The 'Searching Time' is 1 min 2 sec, with a red arrow pointing to the 'Confirm' button. The 'Results' section states that there are 100 possible combinations and lists four solutions in a list box.

Attention: It is not necessary to select the "Direct Drive" (1:1).

The quantity of possible combinations of 2 PGTs that satisfy the conditions is: **100**

Possible Solutions:

<input type="checkbox"/>	bI = - 0.497	bII = - 0.336	Position 1 (1-1')	Assembly B
<input type="checkbox"/>	bI = - 0.497	bII = - 0.336	Position 1 (1-1')	Assembly C
<input type="checkbox"/>	bI = - 0.487	bII = - 0.345	Position 1 (1-1')	Assembly B
<input type="checkbox"/>	bI = - 0.487	bII = - 0.345	Position 1 (1-1')	Assembly C

Pentium III
650 MHz (ano 2000)

Exemplo 2 TEPs: Síntese

Software TEPiciclo – Transmissão

Assemblies vs. Gears (as a function of a fixed output axle)

	A	B	C	D
1st				
2nd				
3rd				
4th				
5th				
6th				

Legend:

Basic Elements:

- PGT I
- PGT II
- Input Element
- Output Element
- Fixed Element

Used PGTs:

- PGT I and PGT II
- only PGT I
- only PGT II

Gears:

Numbers from 1 to 6

Assemblies:

Letters from A to D

Ok

Exemplo 2 TEPs: Síntese

Software TEPiciclo – Transmissão

File **Back** Exit

Assemblies vs. Gears (as a function of a fixed output axle)

	A	B	C	D
1st				
2nd				
3rd				
4th				
5th				
6th				

Legend:

Basic Elements:

- PGT I:
- PGT II:
- Input Element:
- Output Element:
- Fixed Element:

Used PGTs:

- PGT I and PGT II:
- only PGT I:
- only PGT II:

Gears:

- Numbers from 1 to 6

Assemblies:

- Letters from A to D

Ok

Exemplo 2 TEPs: Síntese

Software TEPiciclo – Transmissão

2 PGTs - Determination of the Kinematic Relations through the Gear Ratios

File Back Change View Print Samples Exit

Gear Ratios

Gear Ratio Quantity (1 to 6) Tolerance (0.01 to 10) %

Gear Ratios: : 1 **Tolerance Set:** ~

Limit the search to specific Positions between 2 PGTs

Limit the Train Values interval (bI and bII) standard interval: -0.904 to -0.048

bI to bII to

Limit the Teeth Quantity of the Gears

Gears Teeth Quantity

	Interval:	Values Set:
Ring:	<input type="text"/> to <input type="text"/>	36 to 250
Sun:	<input type="text"/> to <input type="text"/>	12 to 226
Planets:	<input type="text"/> to <input type="text"/>	12 to 119

Searching Time
1 min 2 sec

Attention: It is not necessary to select the "Direct Drive" (1:1).

Results

The quantity of possible combinations of 2 PGTs that satisfy the conditions is: **100**

Possible Solutions:

<input checked="" type="checkbox"/>	bI = - 0.497	bII = - 0.336	Position 1 (1-1')	Assembly B
<input type="checkbox"/>	bI = - 0.497	bII = - 0.336	Position 1 (1-1')	Assembly C
<input type="checkbox"/>	bI = - 0.487	bII = - 0.345	Position 1 (1-1')	Assembly B
<input type="checkbox"/>	bI = - 0.487	bII = - 0.345	Position 1 (1-1')	Assembly C

Exemplo 2 TEPs: Síntese

Software TEPiciclo – Transmissão

2 PGTs - Determination of the Kinematic Relations through the Gear Ratios

File Back Change View Print Samples Exit

Gear Ratios

Gear Ratio Quantity (1 to 6) Tolerance (0.01 to 10) %

Gear Ratios: Tolerance Set:

: 1 **-1.0001 ~ -0.9999**

Limit the search to specific Positions between 2 PGTs

Limit the Train Values interval (bI and bII) standard interval: -0.904 to -0.048

bI to bII to

Limit the Teeth Quantity of the Gears

Gears Teeth Quantity

	Interval:	Values Set:
Ring:	<input type="text"/> to <input type="text"/>	36 to 250
Sun:	<input type="text"/> to <input type="text"/>	12 to 226
Planets:	<input type="text"/> to <input type="text"/>	12 to 119

Searching Time
1 min 2 sec

Confirm
Cancel

Attention: It is not necessary to select the "Direct Drive" (1:1).

Results

Selected Solution for Torque Analysis:

bI = - 0.497 bII = - 0.336 Position 1 (1-1') Assembly B

Cancel
Ok
Torque Analysis

Exemplo 2 TEPs: Síntese

Software TEPiciclo – Transmissão

Exemplo do Projeto de uma Nova Transmissão Automática

RTs:

3,0 :1
1,5 :1
1,0 :1
0,7 :1
-2,5 :1

Tolerância: $\pm 3\%$

Razão Básica [-0,7; -0,5]

TEP II maior que TEP I

Exemplo 2 TEPs: Síntese

Software TEPiciclo – Transmissão

2 PGTs - Determination of the Kinematic Relations through the Gear Ratios

File Back Change View Print Samples Exit

Gear Ratios

Gear Ratio Quantity (1 to 6)

Tolerance (0.01 to 10) %

Gear Ratios: Tolerance Set:

: 1

: 1

: 1

: 1

: 1

: 1

Attention: It is not necessary to select the "Direct Drive" (1:1).

Limit the search to specific Positions between 2 PGTs

Limit the Train Values interval (bI and bII) standard interval: -0.904 to -0.048

bI to bII to

Limit the Teeth Quantity of the Gears

Gears Teeth Quantity

	Interval:	Values Set:
Ring:	<input type="text"/> to <input type="text"/>	36 to 250
Sun:	<input type="text"/> to <input type="text"/>	12 to 226
Planets:	<input type="text"/> to <input type="text"/>	12 to 119

Exemplo 2 TEPs: Síntese

Software TEPiciclo – Transmissão

2 PGTs - Determination of the Kinematic Relations through the Gear Ratios

File Back Change View Print Samples Exit

Gear Ratios

Gear Ratio Quantity (1 to 6)

Tolerance (0.01 to 10) %

<u>Gear Ratios:</u>		<u>Tolerance Set:</u>
<input type="text" value="3"/>	: 1	2.91 ~ 3.09
<input type="text" value="1.5"/>	: 1	1.455 ~ 1.545
<input type="text" value="0.7"/>	: 1	0.679 ~ 0.721
<input type="text" value="-2.5"/>	: 1	-2.575 ~ -2.425

Limit the search to specific Positions between 2 PGTs

Limit the Train Values interval (bI and bII) standard interval: -0.904 to -0.048

bI to bII to

Limit the Teeth Quantity of the Gears

Gears Teeth Quantity

	<u>Interval:</u>	<u>Values Set:</u>
Ring:	<input type="text"/> to <input type="text"/>	36 to 250
Sun:	<input type="text"/> to <input type="text"/>	12 to 226
Planets:	<input type="text"/> to <input type="text"/>	12 to 119

Attention: It is not necessary to select the "Direct Drive" (1:1).

Confirm

Cancel

Exemplo 2 TEPs: Síntese

Software TEPiciclo – Transmissão

2 PGTs - Determination of the Kinematic Relations through the Gear Ratios

File Back Change View Print Samples Exit

Gear Ratios

Gear Ratio Quantity (1 to 6)

Tolerance (0.01 to 10) %

<u>Gear Ratios:</u>		<u>Tolerance Set:</u>
<input type="text" value="3"/>	: 1	2.91 ~ 3.09
<input type="text" value="1.5"/>	: 1	1.455 ~ 1.545
<input type="text" value="0.7"/>	: 1	0.679 ~ 0.721
<input type="text" value="-2.5"/>	: 1	-2.575 ~ -2.425

Limit the search to specific Positions between 2 PGTs

Limit the Train Values interval (bI and bII) standard interval: -0.904 to -0.048

bI to bII to

Limit the Teeth Quantity of the Gears

Gears Teeth Quantity

	<u>Interval:</u>	<u>Values Set:</u>
Ring:	<input type="text"/> to <input type="text"/>	36 to 250
Sun:	<input type="text"/> to <input type="text"/>	12 to 226
Planets:	<input type="text"/> to <input type="text"/>	12 to 119

Attention: It is not necessary to select the "Direct Drive" (1:1).

Confirm

Cancel

Exemplo 2 TEPs: Síntese

Software TEPiciclo – Transmissão

2 PGTs - Determination of the Kinematic Relations through the Gear Ratios

File Back Change View Print Samples Exit

Gear Ratios

Gear Ratio Quantity (1 to 6)

Tolerance (0.01 to 10) %

<u>Gear Ratios:</u>		<u>Tolerance Set:</u>
<input type="text" value="3"/>	: 1	2.91 ~ 3.09
<input type="text" value="1.5"/>	: 1	1.455 ~ 1.545
<input type="text" value="0.7"/>	: 1	0.679 ~ 0.721
<input type="text" value="-2.5"/>	: 1	-2.575 ~ -2.425

Limit the search to specific Positions between 2 PGTs

Limit the Train Values interval (bI and bII) standard interval: -0.904 to -0.048

bI to bII to

Limit the Teeth Quantity of the Gears

Gears Teeth Quantity

	<u>Interval:</u>	<u>Values Set:</u>
Ring:	<input type="text"/> to <input type="text"/>	36 to 250
Sun:	<input type="text"/> to <input type="text"/>	12 to 226
Planets:	<input type="text"/> to <input type="text"/>	12 to 119

Attention: It is not necessary to select the "Direct Drive" (1:1).

Confirm

Cancel

Exemplo 2 TEPs: Síntese

Software TEPiciclo – Transmissão

2 PGTs - Determination of the Kinematic Relations through the Gear Ratios

File Back Change View Print Samples Exit

Gear Ratios

Gear Ratio Quantity (1 to 6) Tolerance (0.01 to 10) %

Gear Ratios:	Tolerance Set:
<input type="text" value="3"/> : 1	2.91 ~ 3.09
<input type="text" value="1.5"/> : 1	1.455 ~ 1.545
<input type="text" value="0.7"/> : 1	0.679 ~ 0.721
<input type="text" value="-2.5"/> : 1	-2.575 ~ -2.425

Limit the search to specific Positions between 2 PGTs

Limit the Train Values interval (bI and bII) standard interval: -0.904 to -0.048

bI to bII to

Limit the Teeth Quantity of the Gears

Gears Teeth Quantity

Interval:	Values Set:
Ring: <input type="text"/> to <input type="text"/>	36 to 250
Sun: <input type="text"/> to <input type="text"/>	12 to 226
Planets: <input type="text"/> to <input type="text"/>	12 to 119

Searching Time
2 min 34 sec

Attention: It is not necessary to select the "Direct Drive" (1:1).

Results

The quantity of possible combinations of 2 PGTs that satisfy the conditions is: **1249**

Possible Solutions:

<input type="checkbox"/>	bI = - 0.545 bII = - 0.637	Position 20 (4-2')	Assembly C
<input type="checkbox"/>	bI = - 0.545 bII = - 0.636	Position 20 (4-2')	Assembly C
<input type="checkbox"/>	bI = - 0.545 bII = - 0.635	Position 20 (4-2')	Assembly C
<input type="checkbox"/>	bI = - 0.545 bII = - 0.634	Position 20 (4-2')	Assembly C

Exemplo 2 TEPs: Síntese

Software TEPiciclo – Transmissão

2 PGTs - Determination of the Kinematic Relations through the Gear Ratios

File Back Change View Print Samples Exit

Gear Ratios

Gear Ratio Quantity (1 to 6) Tolerance (0.01 to 10) %

Gear Ratios: Tolerance Set:

: 1 **2.91 ~ 3.09**

: 1 **1.455 ~ 1.545**

: 1 **0.679 ~ 0.721**

: 1 **-2.575 ~ -2.425**

Limit the search to specific Positions between 2 PGTs

Limit the Train Values interval (bI and bII) standard interval: -0.904 to -0.048

bI to bII to

Limit the Teeth Quantity of the Gears

Gears Teeth Quantity

Interval: Values Set:

Ring: to 36 to 250

Sun: to 12 to 226

Planets: to 12 to 119

Searching Time
2 min 34 sec

Attention: It is not necessary to select the "Direct Drive" (1:1).

Results

The quantity of possible combinations of 2 PGTs that satisfy the conditions is: **1249**

Possible Solutions:

<input type="checkbox"/>	bI = - 0.545	bII = - 0.637	Position 20 (4-2')	Assembly C
<input type="checkbox"/>	bI = - 0.545	bII = - 0.636	Position 20 (4-2')	Assembly C
<input type="checkbox"/>	bI = - 0.545	bII = - 0.635	Position 20 (4-2')	Assembly C
<input type="checkbox"/>	bI = - 0.545	bII = - 0.634	Position 20 (4-2')	Assembly C

Exemplo 2 TEPs: Síntese

Software TEPiciclo – Transmissão

2 PGTs - Determination of the Kinematic Relations through the Gear Ratios

File Back Change View Print Samples Exit

Gear Ratios

Gear Ratio Quantity (1 to 6) Tolerance (0.01 to 10) %

Gear Ratios:	Tolerance Set:
<input type="text" value="3"/> : 1	2.91 ~ 3.09
<input type="text" value="1.5"/> : 1	1.455 ~ 1.545
<input type="text" value="0.7"/> : 1	0.679 ~ 0.721
<input type="text" value="-2.5"/> : 1	-2.575 ~ -2.425

Limit the search to specific Positions between 2 PGTs

Limit the Train Values interval (bI and bII) standard interval: -0.904 to -0.048

bI to bII to

Limit the Teeth Quantity of the Gears

Gears Teeth Quantity

Interval:	Values Set:
Ring: <input type="text"/> to <input type="text"/>	36 to 250
Sun: <input type="text"/> to <input type="text"/>	12 to 226
Planets: <input type="text"/> to <input type="text"/>	12 to 119

Searching Time
2 min 34 sec

Attention: It is not necessary to select the "Direct Drive" (1:1).

Results

The quantity of possible combinations of 2 PGTs that satisfy the conditions is: **1249**

Possible Solutions:

<input checked="" type="checkbox"/>	bI = - 0.545 bII = - 0.637	Position 20 (4-2')	Assembly C
<input type="checkbox"/>	bI = - 0.545 bII = - 0.636	Position 20 (4-2')	Assembly C
<input type="checkbox"/>	bI = - 0.545 bII = - 0.635	Position 20 (4-2')	Assembly C
<input type="checkbox"/>	bI = - 0.545 bII = - 0.634	Position 20 (4-2')	Assembly C

Exemplo 2 TEPs: Síntese

Software TEPiciclo – Transmissão

2 PGTs - Determination of the Kinematic Relations through the Gear Ratios

File Back Change View Print Samples Exit

Gear Ratios

Gear Ratio Quantity (1 to 6) Tolerance (0.01 to 10) %

Gear Ratios:	Tolerance Set:
<input type="text" value="3"/> : 1	2.91 ~ 3.09
<input type="text" value="1.5"/> : 1	1.455 ~ 1.545
<input type="text" value="0.7"/> : 1	0.679 ~ 0.721
<input type="text" value="-2.5"/> : 1	-2.575 ~ -2.425

Limit the search to specific Positions between 2 PGTs

Limit the Train Values interval (bI and bII) standard interval: -0.904 to -0.048

bI to bII to

Limit the Teeth Quantity of the Gears

Gears Teeth Quantity

Interval:	Values Set:
Ring: <input type="text"/> to <input type="text"/>	36 to 250
Sun: <input type="text"/> to <input type="text"/>	12 to 226
Planets: <input type="text"/> to <input type="text"/>	12 to 119

Searching Time
2 min 34 sec

Attention: It is not necessary to select the "Direct Drive" (1:1).

Results

Selected Solution for Torque Analysis:

<input checked="" type="checkbox"/> bI = - 0.545 bII = - 0.637 Position 20 (4-2') Assembly C	<input type="button" value="Cancel"/>
	<input type="button" value="Ok"/>
	<input type="button" value="Torque Analysis"/>

Exemplo 2 TEPs: Síntese

Software TEPiciclo – Transmissão

2 PGTs - Determination of the Kinematic Relations through the Gear Ratios

File Back Change View Print Samples Exit

Gear Ratios

Gear Ratio Quantity (1 to 6)

Gear Ratios:	Tolerance
3 : 1	2.91 ~ 3
1.5 : 1	1.455 ~ 1.5
0.7 : 1	0.679 ~ 0.7
-2.5 : 1	-2.575 ~ -2.5

Attention: It is not necessary to set the "Direct Drive" (1:1).

Parameters Selection for the Torque Analysis

Limiting Parameters for the search

Train Value **bI: -0.545** **bII: -0.637**

Limit the Gears Teeth Quantity

	Desired Interval:	Values Set:
Ring:	[] to []	36 to 250
Sun:	[] to []	12 to 226
Planets:	[] to []	12 to 119

Searching Time: 2 min 34 sec

Planets: [] to [] 12 to 119

Results

Selected Solution for Torque Analysis:

<input checked="" type="checkbox"/> bI = -0.545 bII = -0.637 Position 20 (4-2') Assembly C
--

Exemplo 2 TEPs: Síntese

Software TEPiciclo – Transmissão

The screenshot displays the '2 PGTs - Determination of the Kinematic Relations through the Gear Ratios' window. A 'Parameters Selection for the Torque Analysis' dialog box is open, showing search parameters. The 'Limiting Parameters for the search' section includes 'Train Value' with $bI: -0.545$ and $bII: -0.637$, and a checkbox for 'Limit the Gears Teeth Quantity'. The 'Desired Interval' and 'Values Set' sections show ranges for Ring, Sun, and Planets gears. The 'Searching Time' is 2 min 34 sec. The 'Results' section shows the selected solution: $bI = -0.545$, $bII = -0.637$, Position 20 (4-2'), Assembly C.

2 PGTs - Determination of the Kinematic Relations through the Gear Ratios

File Back Change View Print Samples Exit

Gear Ratios

Gear Ratio Quantity (1 to 6)

Gear Ratios:	Tolerance
3 : 1	2.91 ~ 3
1.5 : 1	1.455 ~ 1.5
0.7 : 1	0.679 ~ 0.7
-2.5 : 1	-2.575 ~ -2.5

Attention: It is not necessary to set the "Direct Drive" (1:1).

Parameters Selection for the Torque Analysis

Limiting Parameters for the search

Train Value **bI: -0.545** **bII: -0.637**

Limit the Gears Teeth Quantity

Desired Interval: Values Set:

Ring: [] to [] 36 to 250

Sun: [] to [] 12 to 226

Planets: [] to [] 12 to 119

Confirm Change Cancel

Searching Time: 2 min 34 sec

Confirm Cancel

Results

Selected Solution for Torque Analysis:

<input checked="" type="checkbox"/>	$bI = -0.545$	$bII = -0.637$	Position 20 (4-2')	Assembly C
-------------------------------------	---------------	----------------	--------------------	------------

Cancel Ok Torque Analysis

Exemplo 2 TEPs: Síntese

Software TEPiciclo – Transmissão

2 PGTs - Determination of the Kinematic Relations through the Gear Ratios

File Back Change View Print Samples Exit

Parameters Selection for the Torque Analysis

Limiting Parameters for the search

Train Value **bI: -0.545** **bII: -0.637**

Limit the Gears Teeth Quantity

Desired Interval: Values Set:

Ring: to 36 to 250

Sun: to 12 to 226

Planets: to 12 to 119

Results

Select the PGTs for the Torque Analysis:

PGT I: **10 options**

- Zr = 66 Zs = 36 Zp = 15
- Zr = 88 Zs = 48 Zp = 20
- Zr = 101 Zs = 55 Zp = 23

PGT II: **10 options**

- Zr = 66 Zs = 42 Zp = 12
- Zr = 77 Zs = 49 Zp = 14
- Zr = 88 Zs = 56 Zp = 16

The "Direct Drive" (1:1), Planets: to 12 to 119

Results

Selected Solution for Torque Analysis:

- bI = - 0.545 bII = - 0.637 Position 20 (4-2') Assembly C

Exemplo 2 TEPs: Síntese

Software TEPiciclo – Transmissão

2 PGTs - Determination of the Kinematic Relations through the Gear Ratios

File Back Change View Print Samples Exit

Parameters Set

Limiting Parameters

Train Value

Limit the Gears

Desire

Ring:

Sun:

Planets:

Confirm

The Direct Drive (1

Results

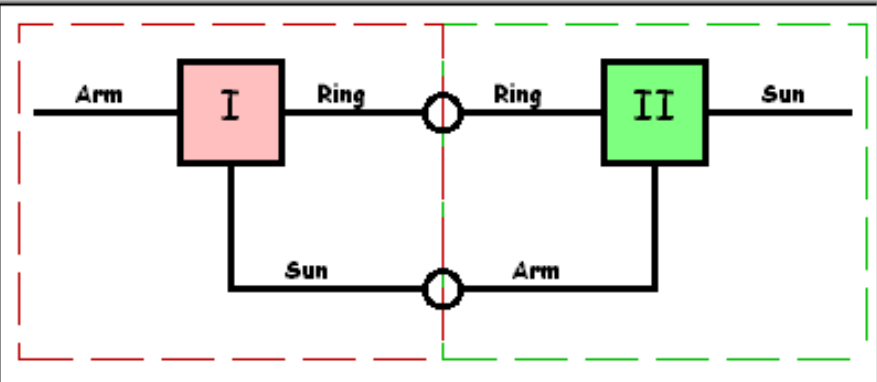
Selected Solution for

bI = - 0.545 bII

Torque Analysis vs. Gear Ratio

Close View Print

Position



Select a Gear for the analysis:

<input checked="" type="radio"/> 1st 1.159 : 1	<input type="radio"/> 3rd 2.956 : 1	<input type="radio"/> 5th 1.545 : 1
<input type="radio"/> 2nd 0.708 : 1	<input type="radio"/> 4th 2.835 : 1	<input type="radio"/> 6th -2.425 : 1

Confirm

Back

PGT I

Teeth Quantity:

Ring

Sun

Planets

PGT II

Teeth Quantity:

Ring

Sun

Planets

Exemplo 2 TEPs: Síntese

Software TEPiciclo – Transmissão

2 PGTs - Determination of the Kinematic Relations through the Gear Ratios

File Back Change View Print Samples Exit

Parameters Set Torque Analysis vs. Gear Ratio

Close View Print

Limiting Parameters

Train Value

Limit the Gears

Desire

Ring:

Sun:

Planets:

Confirm

The Direct Drive (1

Results

Selected Solution for

bI = - 0.545 bII

PGT I

Teeth Quantity:

Ring

Sun

Planets

PGT II

Teeth Quantity:

Ring

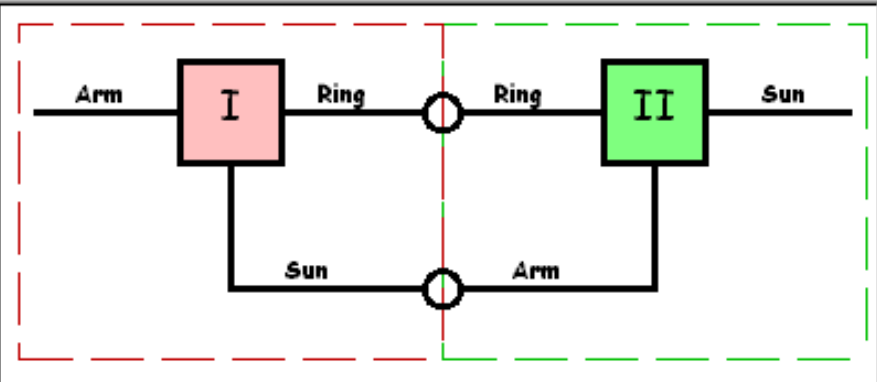
Sun

Planets

Confirm

Back

Position



Select a Gear for the analysis:

1st 1.159 : 1

2nd 0.708 : 1

3rd 2.956 : 1

4th 2.835 : 1

5th 1.545 : 1

6th -2.425 : 1

Exemplo 2 TEPs: Síntese

Software TEPiciclo – Transmissão

"Map" of the Results

	1'				2'				3'				4'				5'				6'			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
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	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
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	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
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	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6

Legend:

- 1st Gear
- 2nd Gear
- 3rd Gear
- 4th Gear
- 5th Gear
- 6th Gear

Train Value:

b_I :

b_{II} :

Tolerance:

Gear Values:

1st: 1.412 ~ 1.412

2nd: 1.636 ~ 1.636

3rd: 3.429 ~ 3.43

4th: -0.545 ~ -0.545

5th: 2.572 ~ 2.573

6th: 0.353 ~ 0.353

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Exemplo 2 TEPs: Síntese

Software TEPiciclo – Transmissão

"Map" of the Results

	1'				2'				3'				4'				5'				6'			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
2	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
3	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
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	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
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	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Caption:

- 1st Gear
- 2nd Gear
- 3rd Gear
- 4th Gear
- 5th Gear
- 6th Gear

Train Value:

b_I :

b_{II} :

Tolerance:

Gear Values:

1st: 1.412 ~ 1.412

2nd: 1.636 ~ 1.636

3rd: 3.429 ~ 3.43

4th: -0.545 ~ -0.545

5th: 2.572 ~ 2.573

6th: 0.353 ~ 0.353

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Transmissões Veiculares

Transmissão Automática



- ZF 6HP26
- 1ª Transmissão 6-marchas para automóveis em série fabricada no mundo (~ ano 2001)

RT	1ª	2ª	3ª	4ª	5ª	6ª	ré
	4,17	2,34	1,52	1,14	0,86	0,69	-3,40

Transmissões Veiculares

Transmissão Automática



BMW 7 Series Sedan

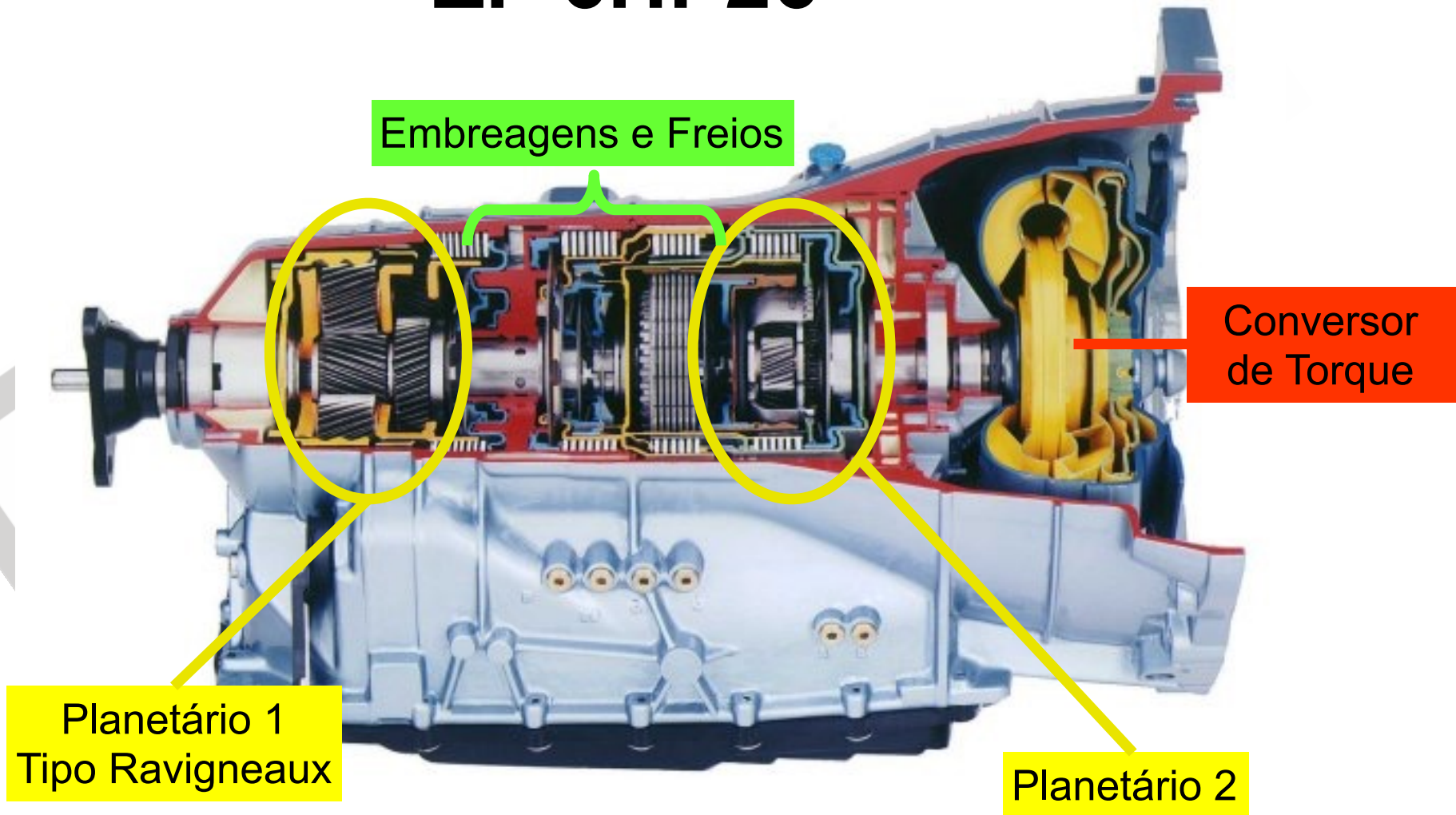


Transmissões Veiculares

Caixas ZF



ZF 6HP26

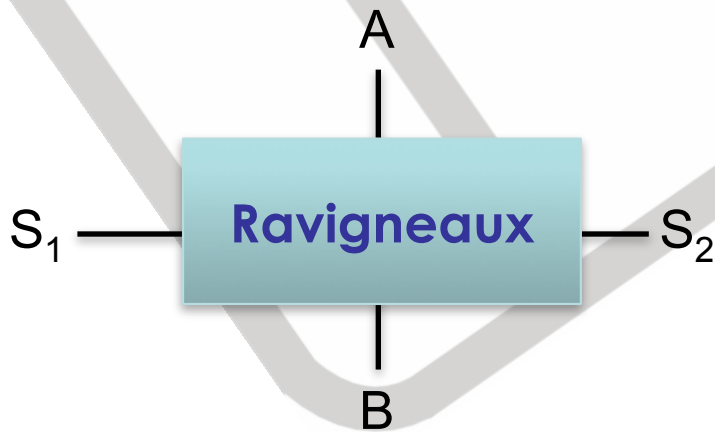
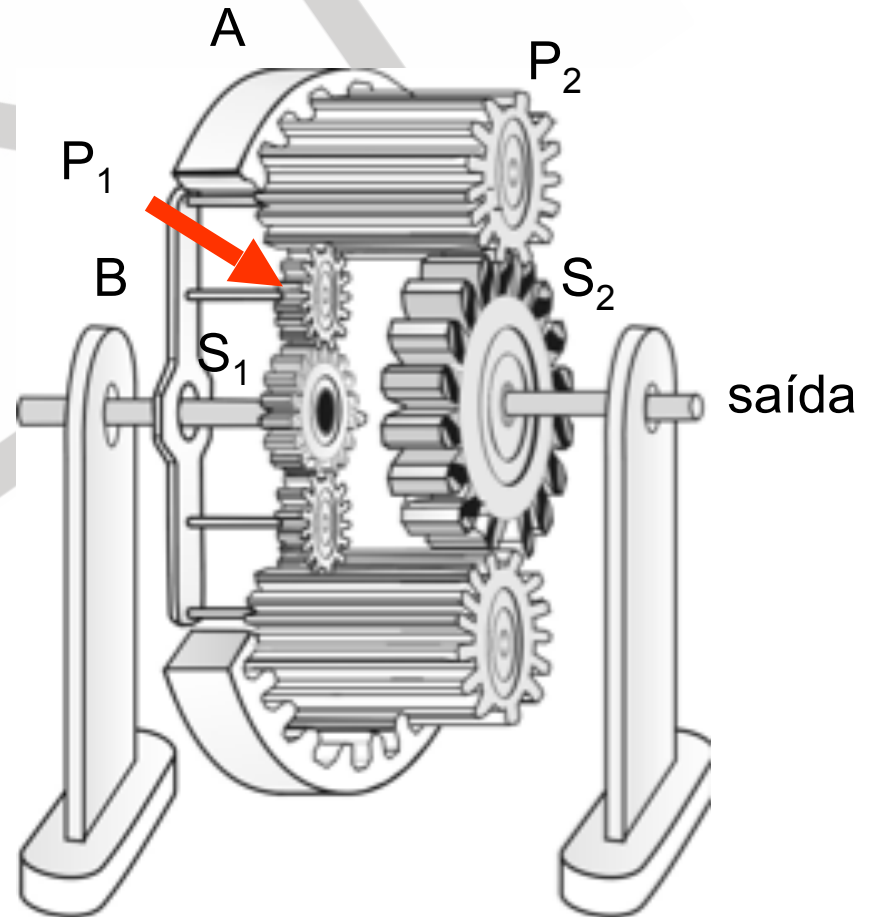
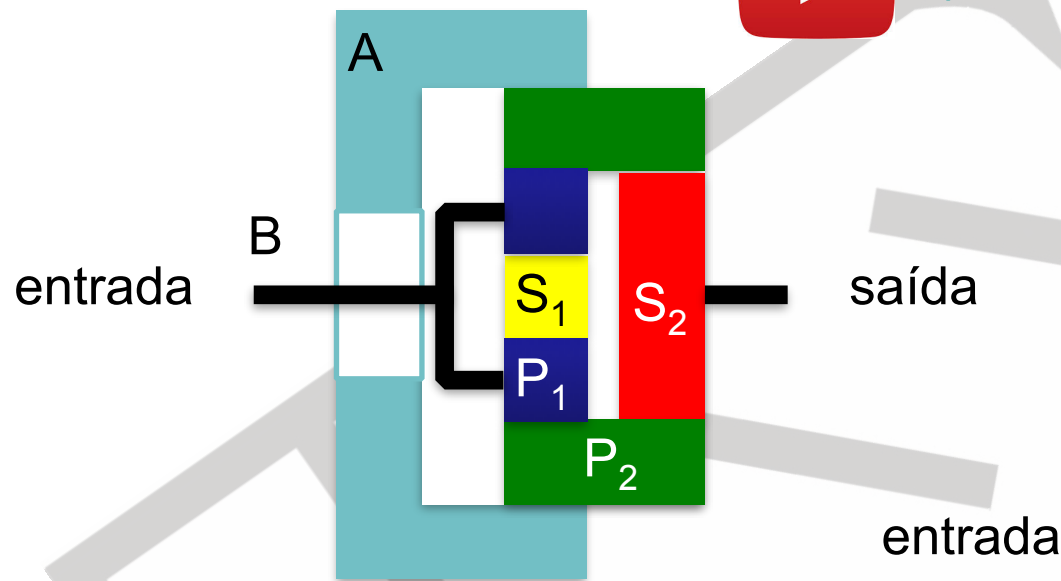


Transmissões Veiculares

Caixas Ravigneaux



<http://www.youtube.com/watch?v=7iTn8OWxVFU>



Exemplo 2 TEPs: Síntese

Software TEPiciclo – Transmissão

- Resultados obtidos para 2 TEPs Simples (RT):

ZF 6HP26 (RT:1)	2 TEPs Simples (RT:1)	Diferença (%)
4,171	4,068	2,47
2,340	2,468	6,24
1,521	1,673	9,99
1,143	1,000	12,51
0,867	0,781	9,96
0,691	0,674	2,45
-3,403	-3,559	4,58

Região próxima à Direct-Drive (1:1)

Fonte: TEPiciclo - A Software to Help the Planetary Gear Trains Design – SAE Technical Paper #: 2003-01-0679, DOI: 10.4271/2003-01-0679
 Authors: Becker, M., Amaral, D., and Dedini, F.

Exemplo 2 TEPs: Síntese

Software TEPiciclo – Transmissão

- Resultados obtidos para a Mudança de Marcha:

Troca de	ZF 6HP26	2 TEPs	Diferença (%)
1 → 2	1,78	1,63	8,43
2 → 3	1,53	1,48	3,27
3 → 4	1,33	1,67	25,6
4 → 5	1,32	1,27	3,78
5 → 6	1,25	1,16	7,20

Região próxima à Direct-Drive (1:1)

Fonte: TEPiciclo - A Software to Help the Planetary Gear Trains Design – SAE Technical Paper #: 2003-01-0679, DOI: 10.4271/2003-01-0679
Authors: Becker, M., Amaral, D., and Dedini, F.