SEM0104 – Aula 9

Exemplo de Aplicação:

Software TEPiciclo

Prof. Assoc. Marcelo Becker

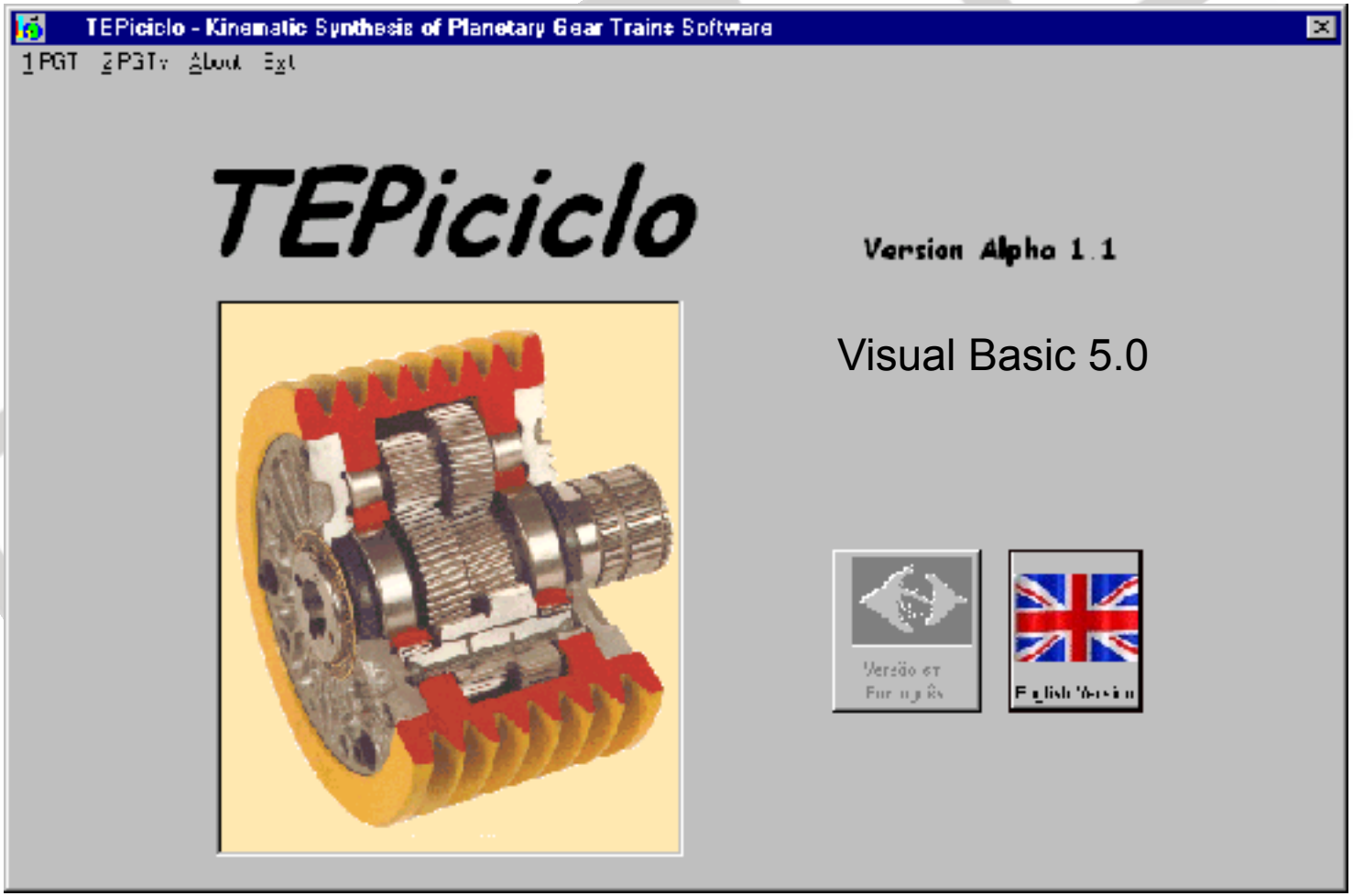
USP - EESC - SEM

LabRoM

Sumário da Aula

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

Software TEPiciclo



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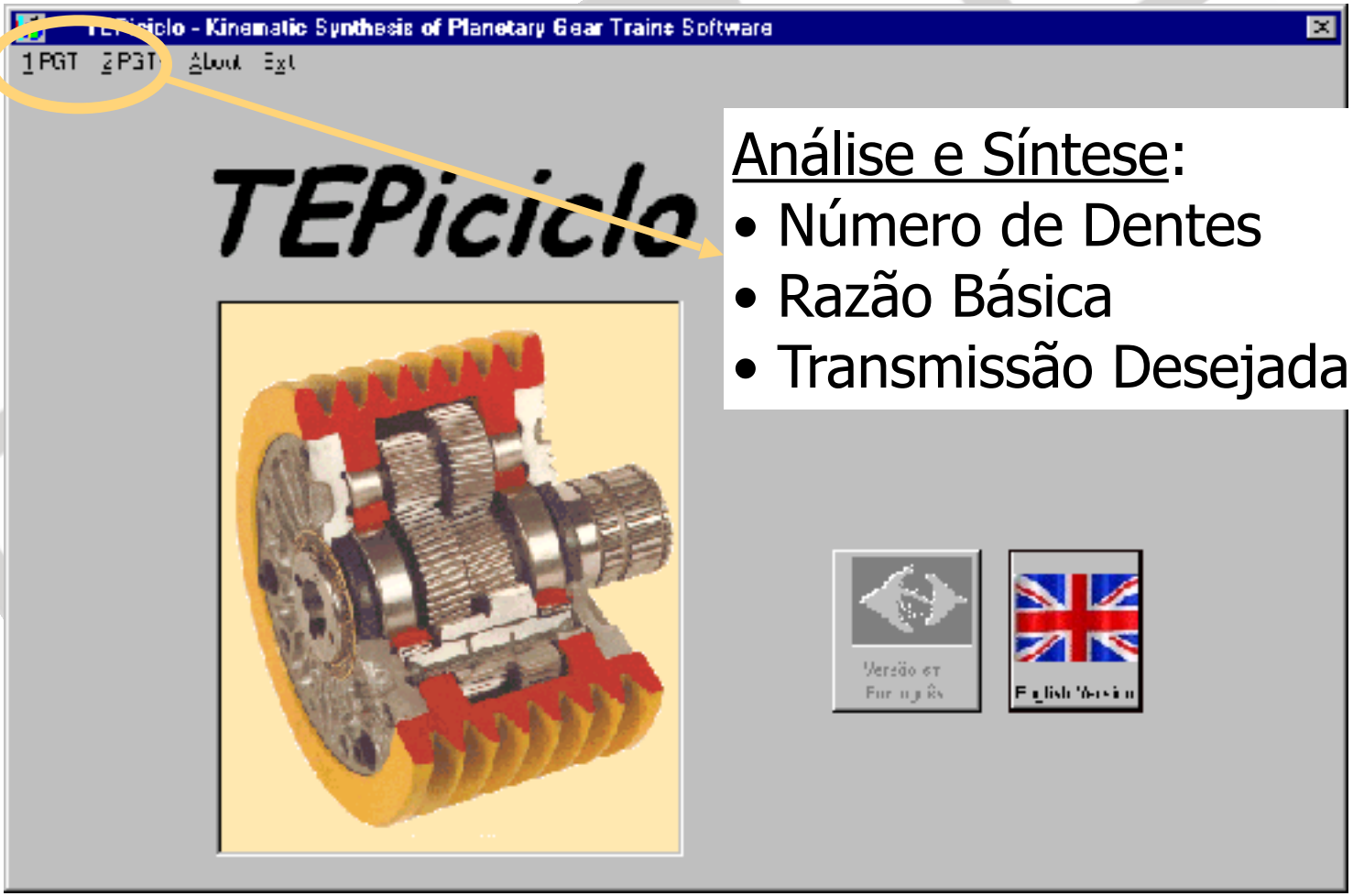

Análise e Síntese:

- Número de Dentes
- Razão Básica
- Transmissão Desejada

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Exemplo 1 TEP: Análise

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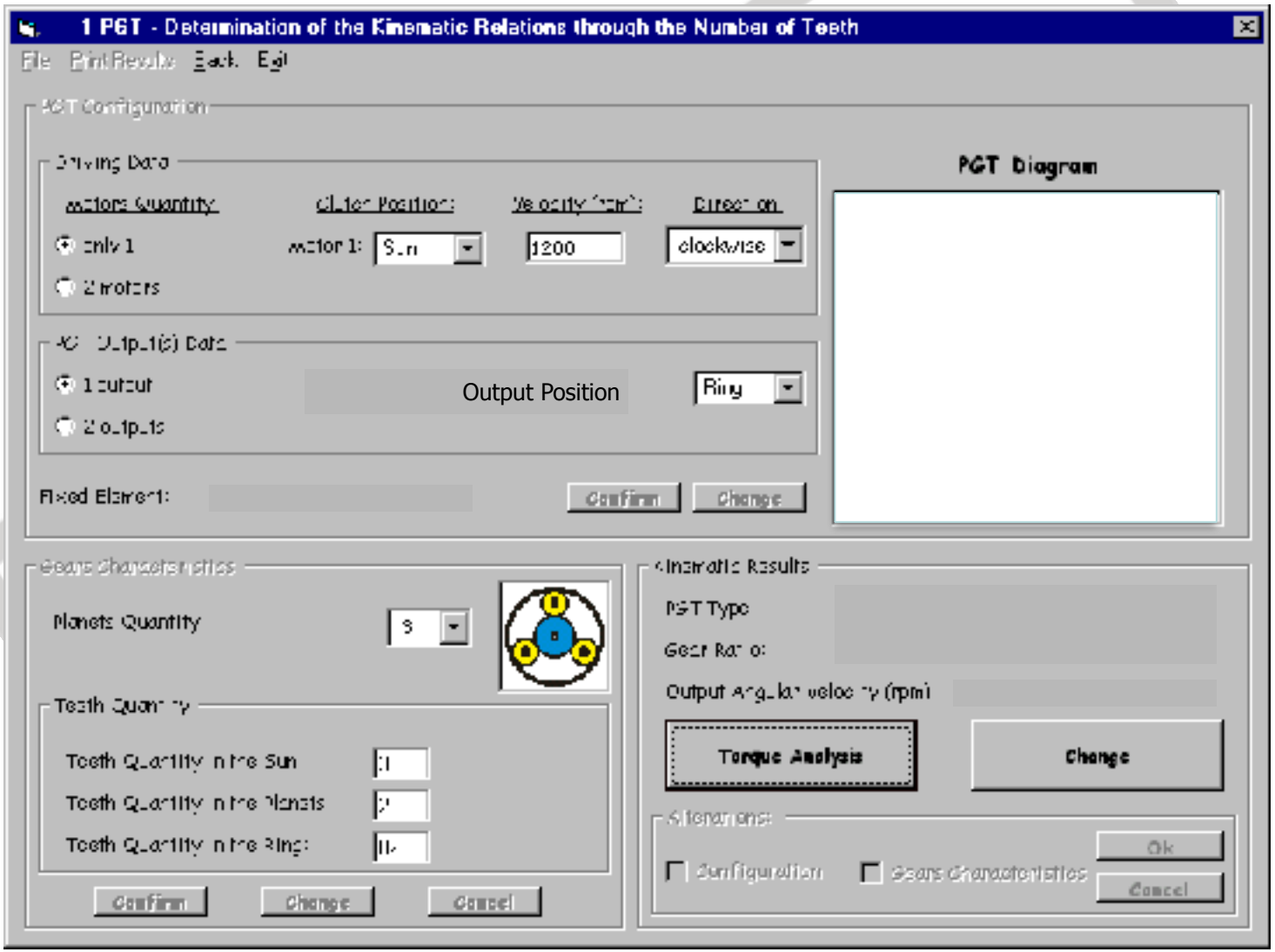

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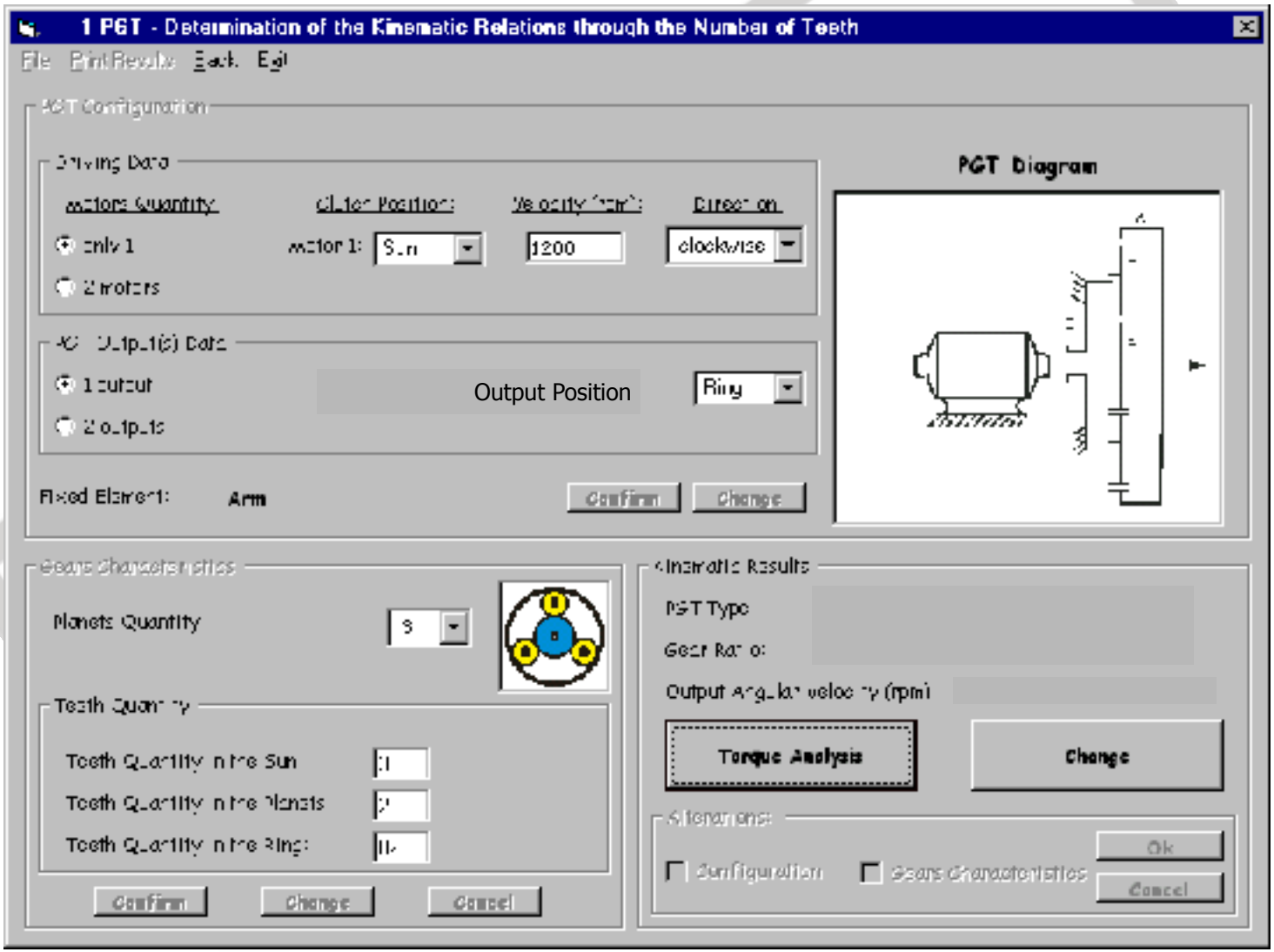

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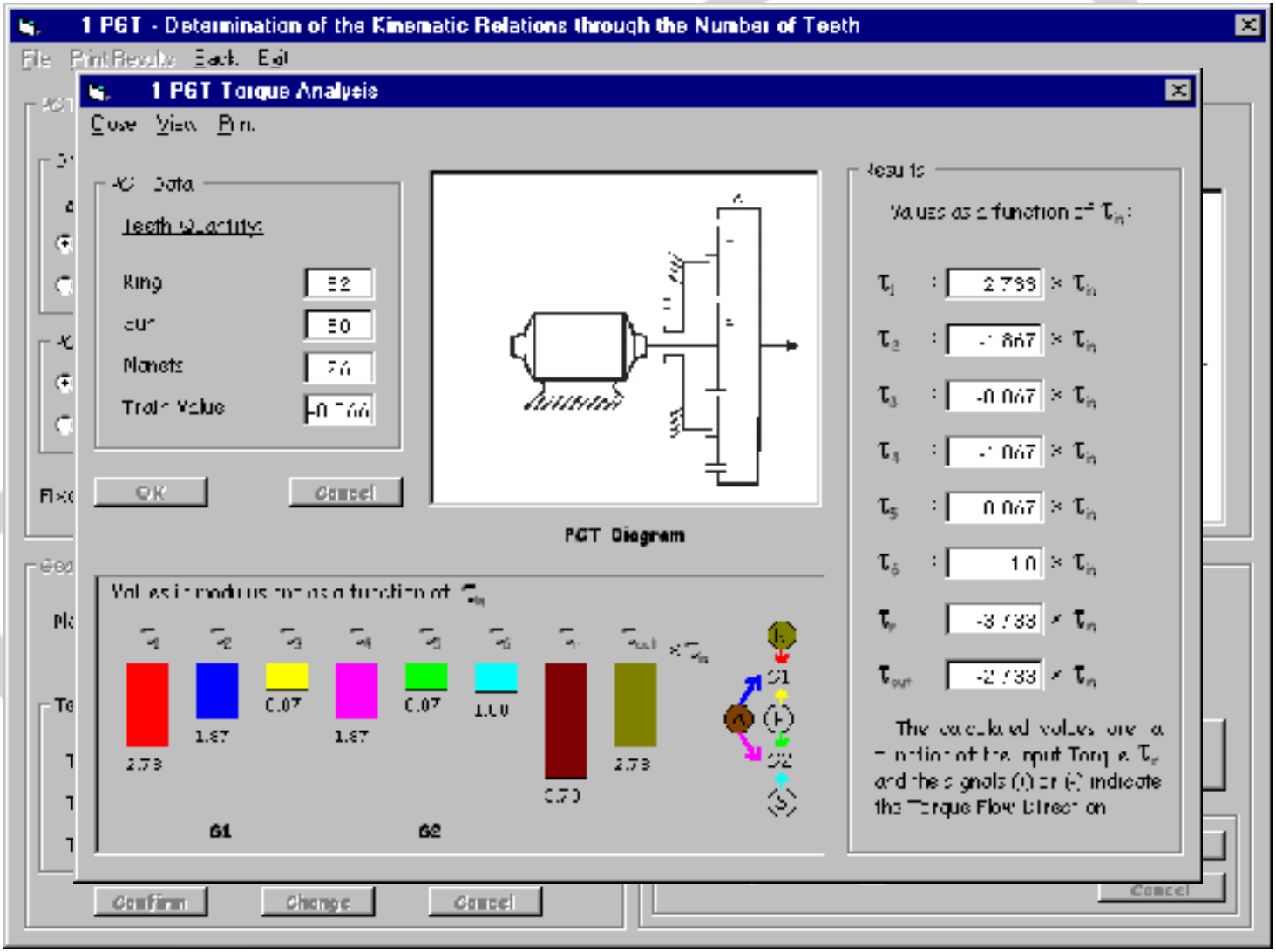

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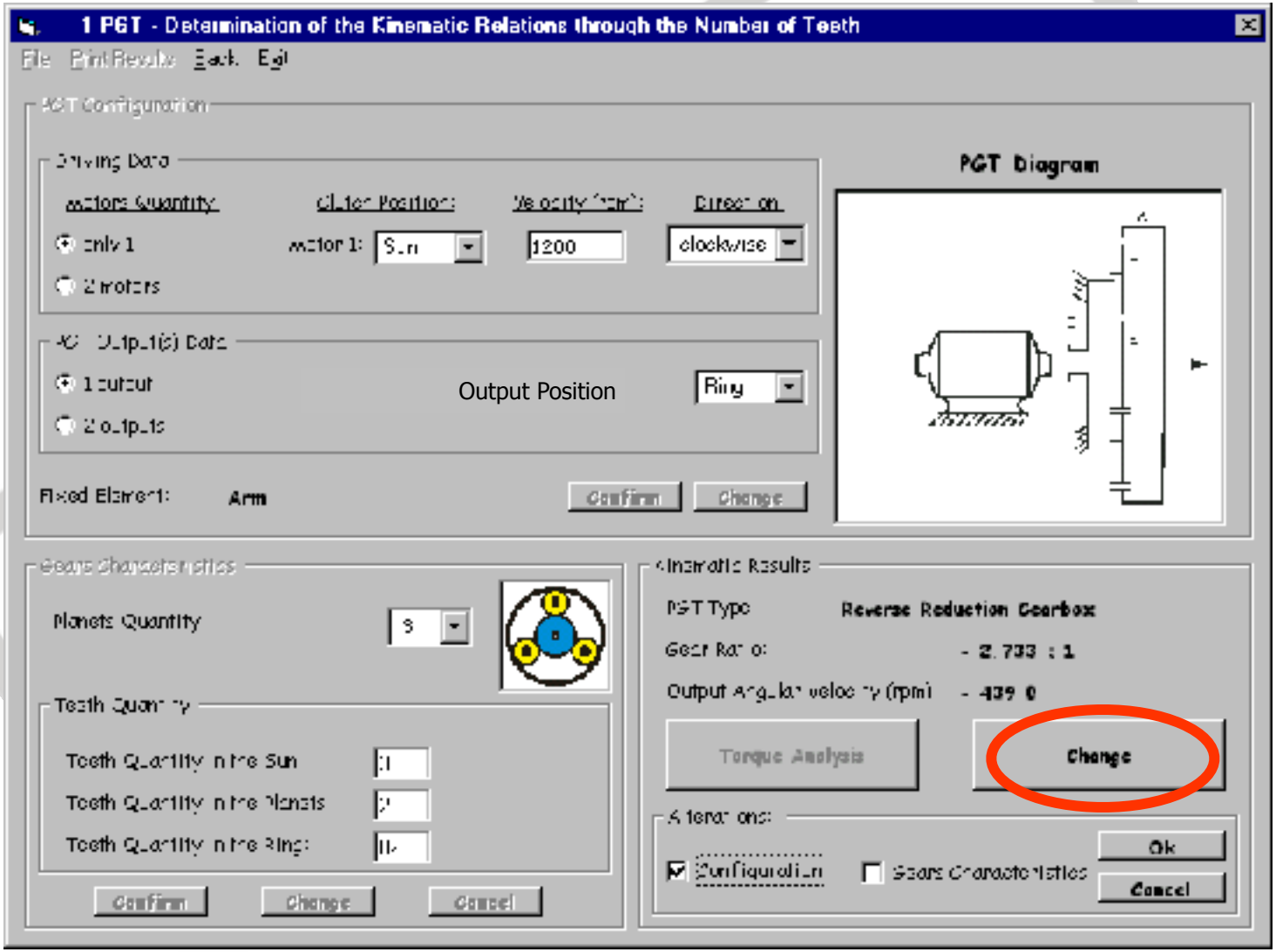

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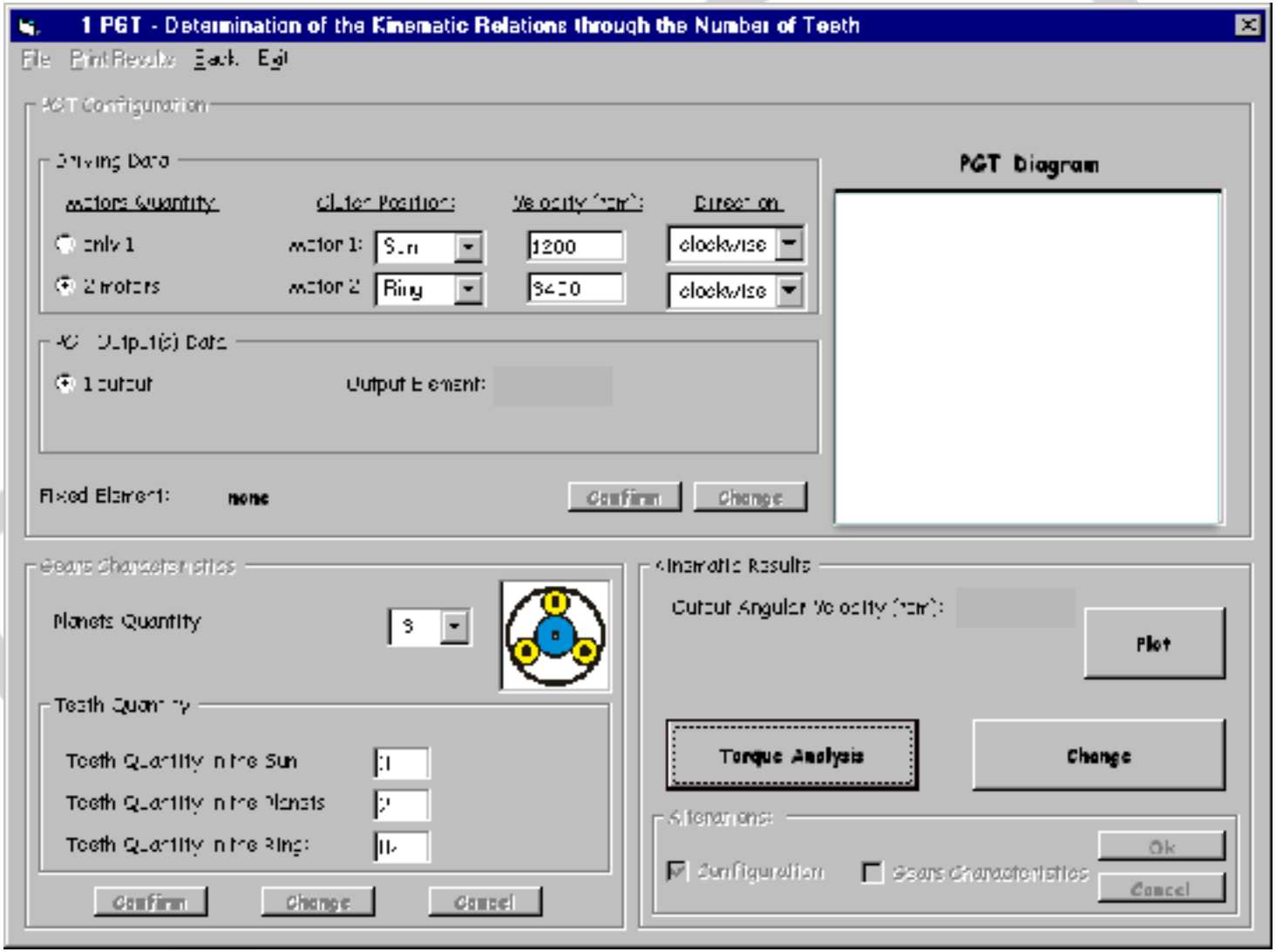

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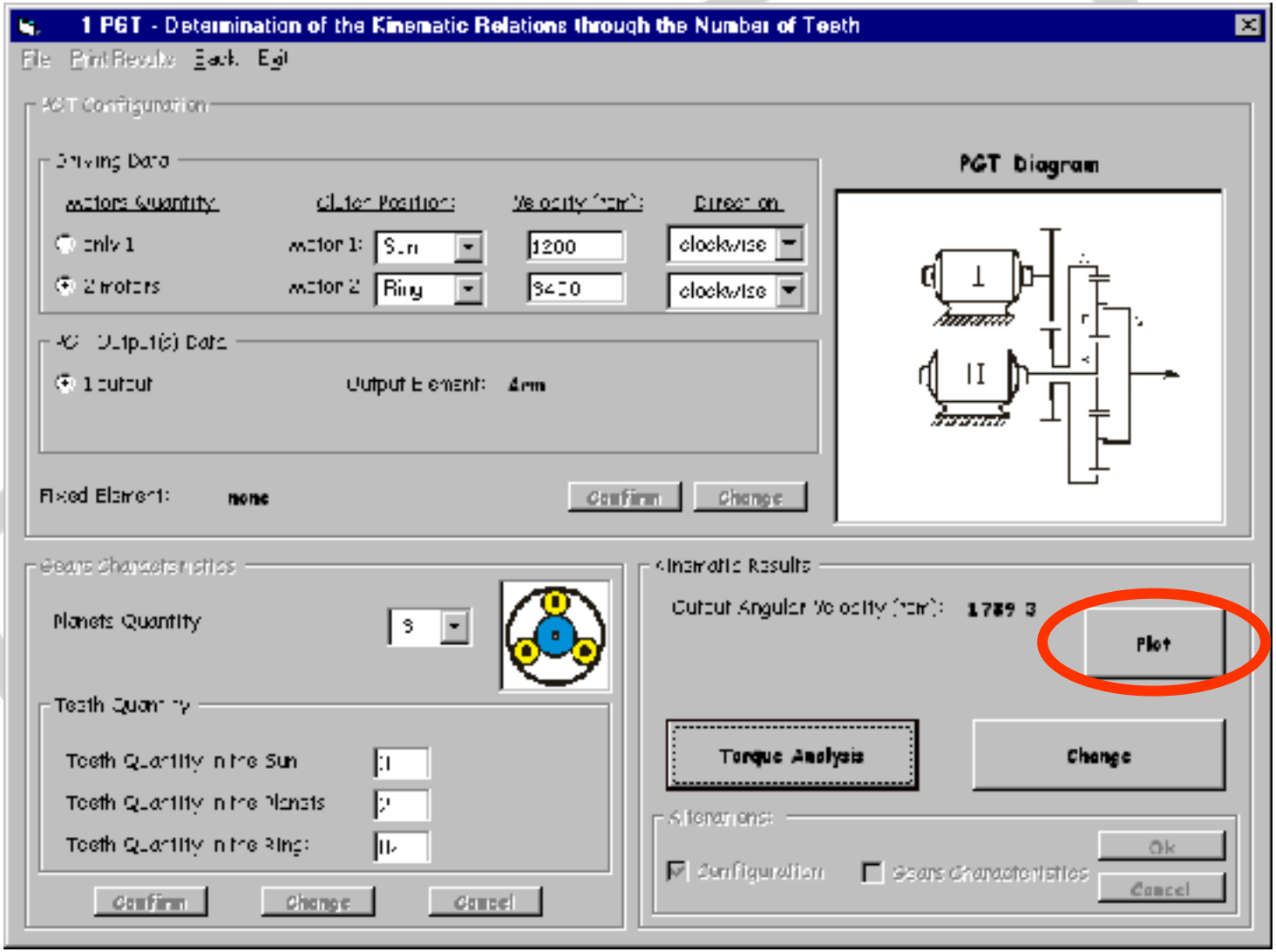

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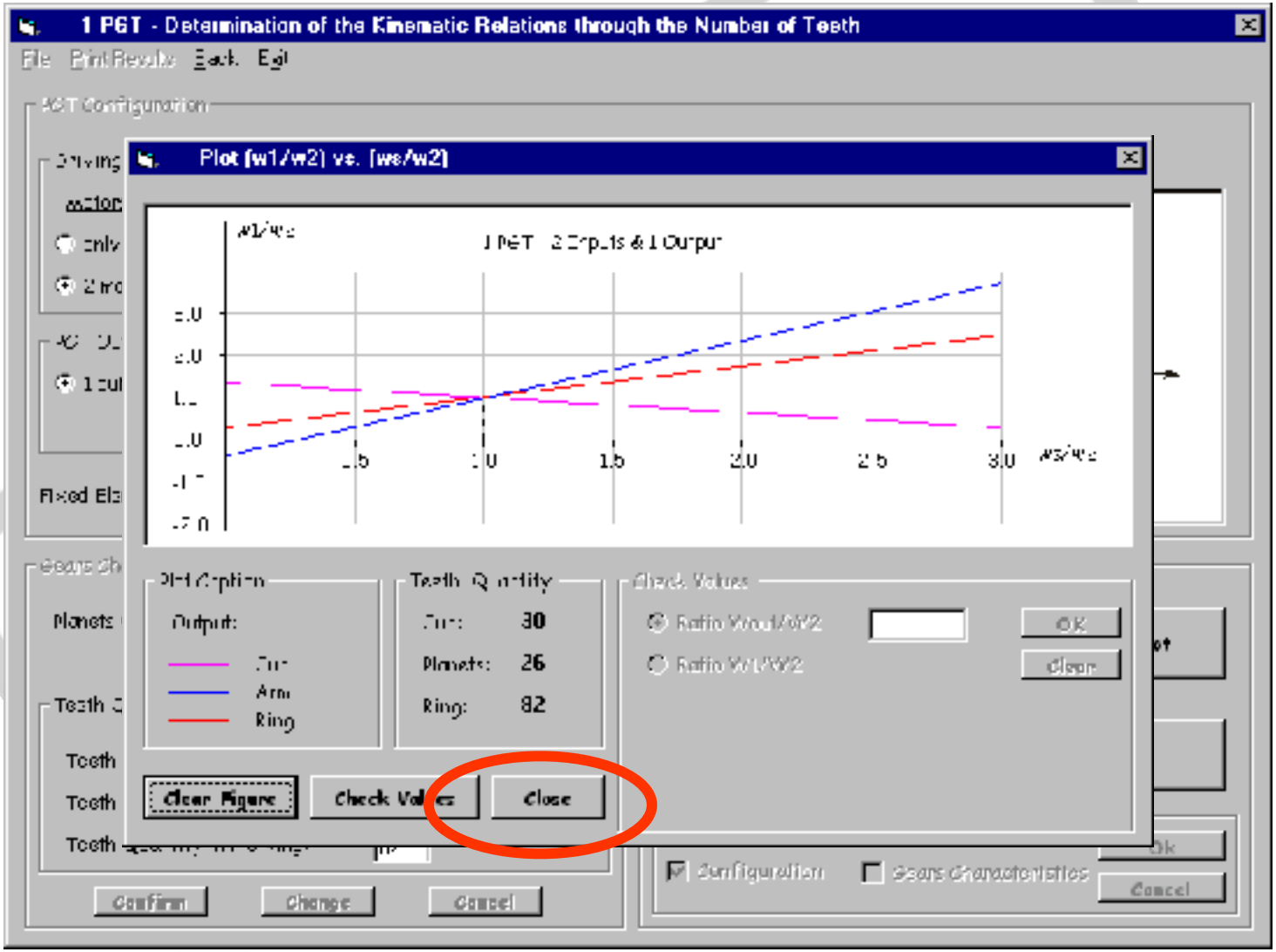

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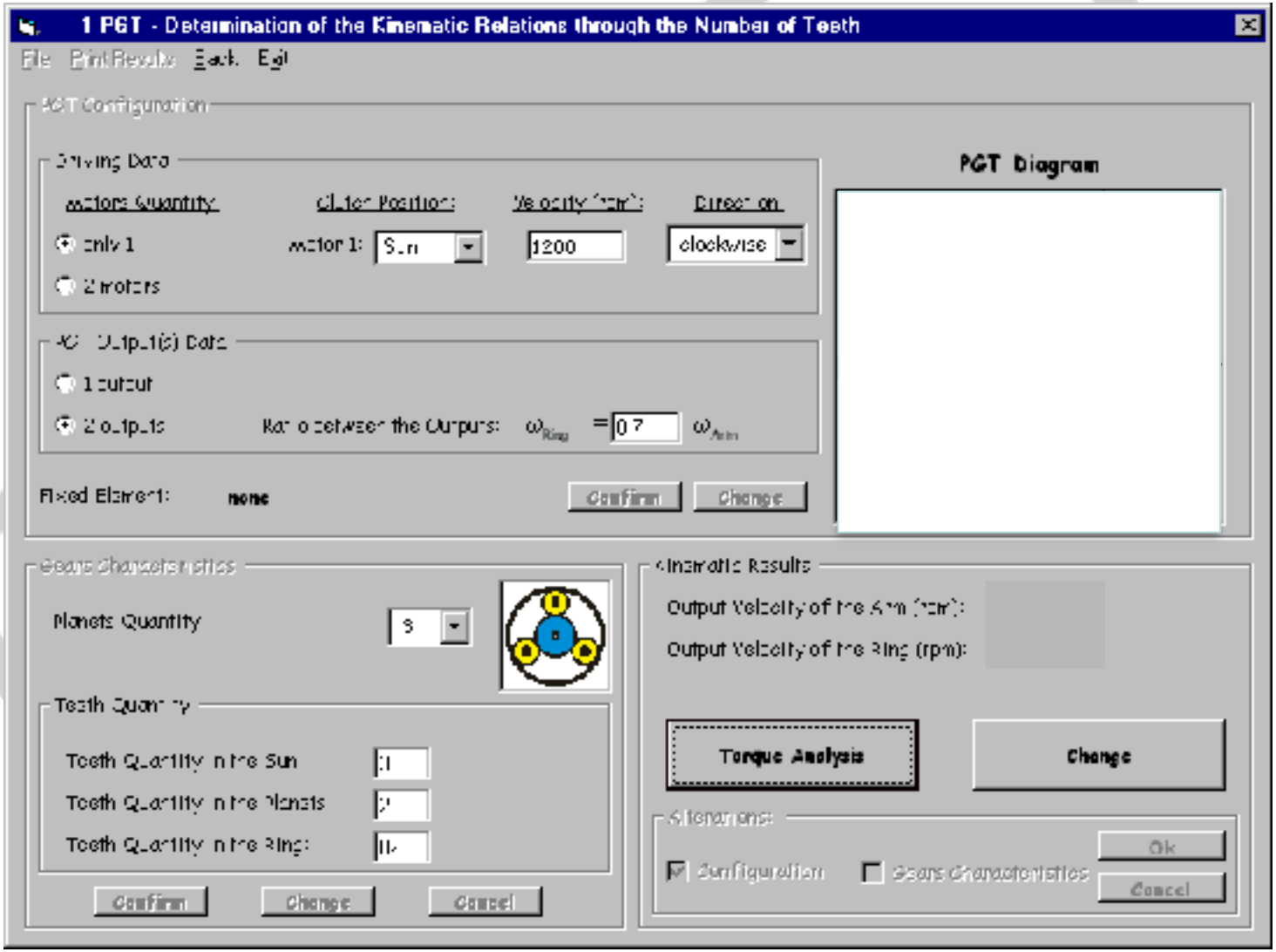

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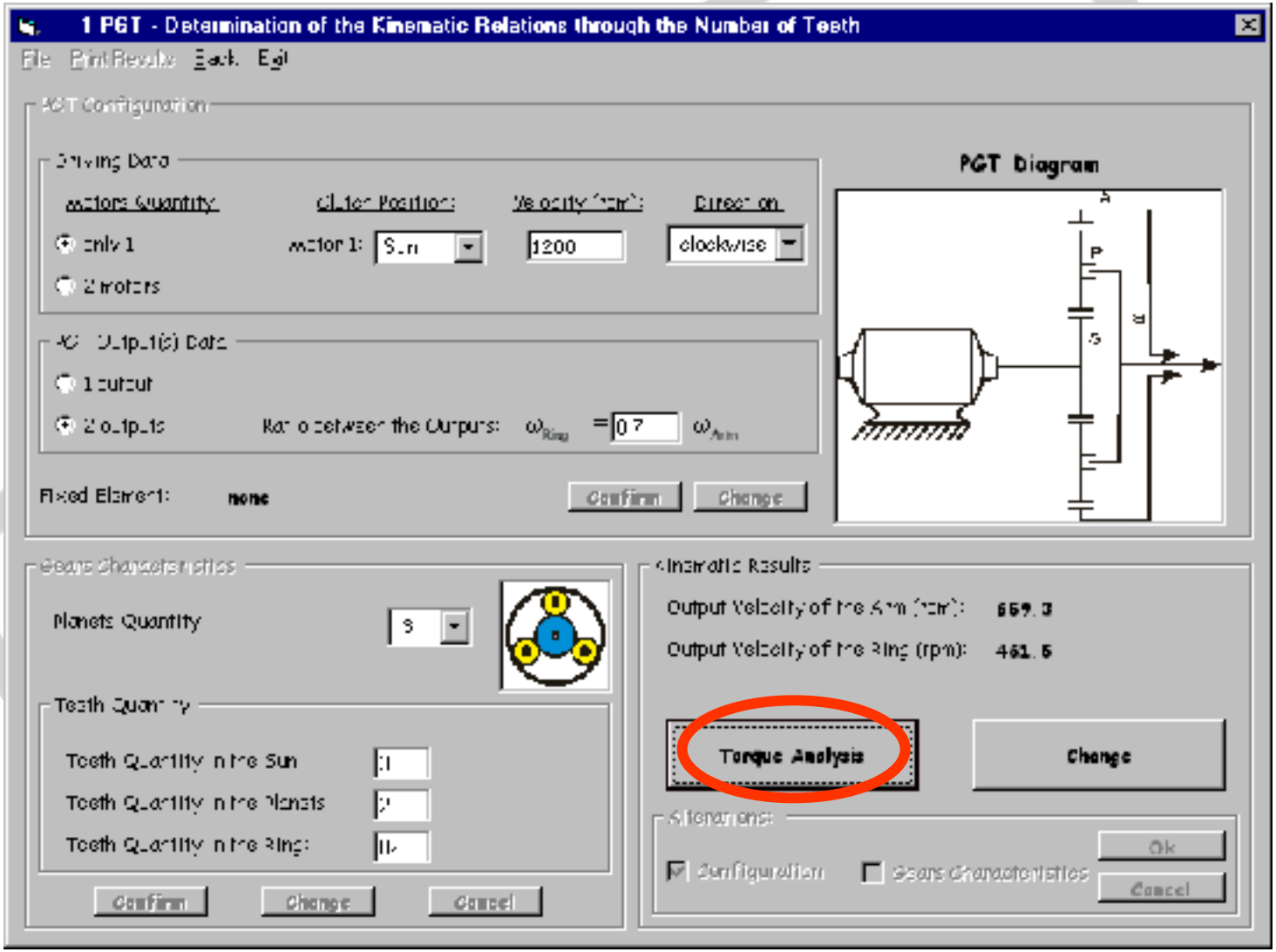

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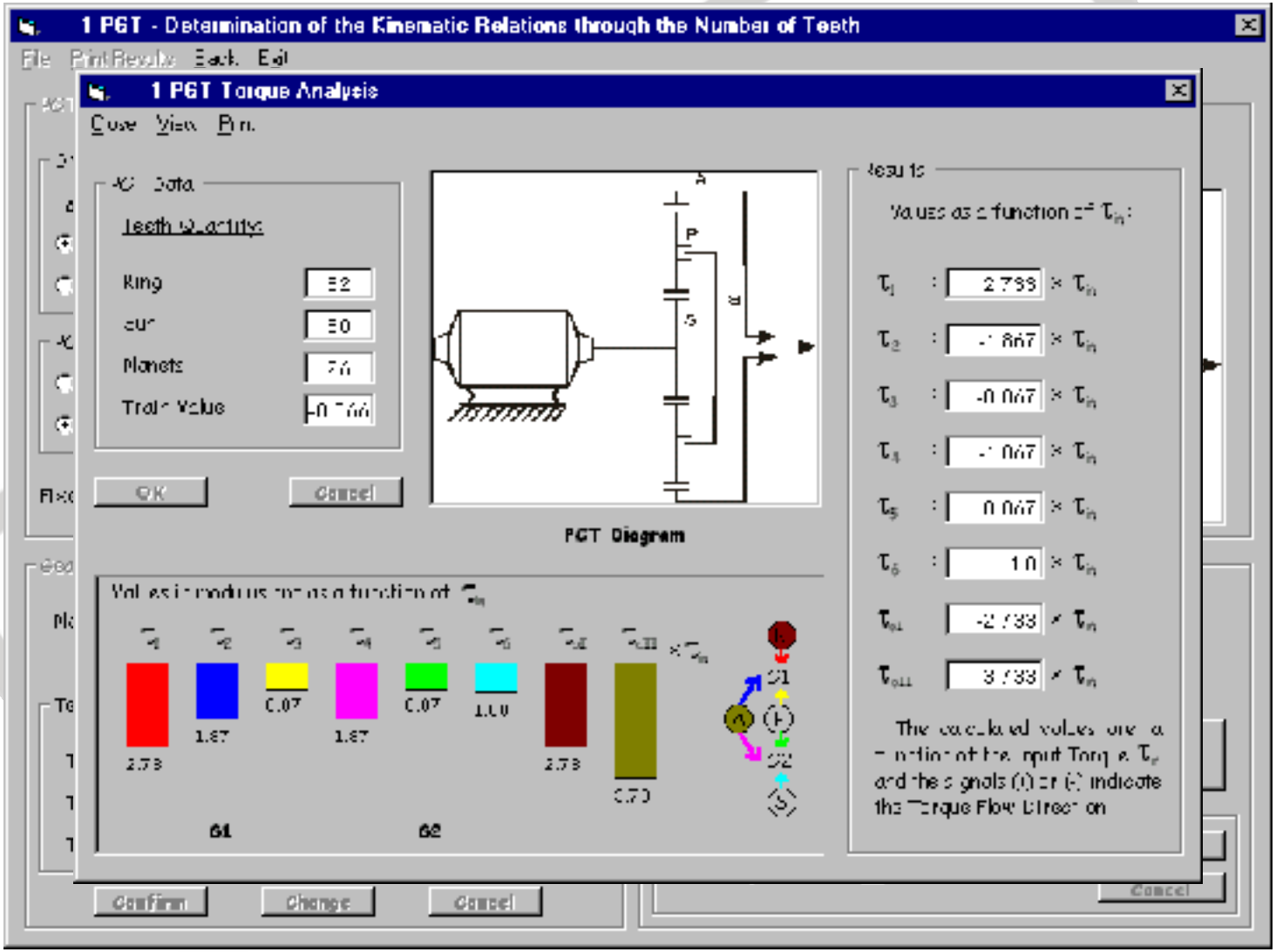

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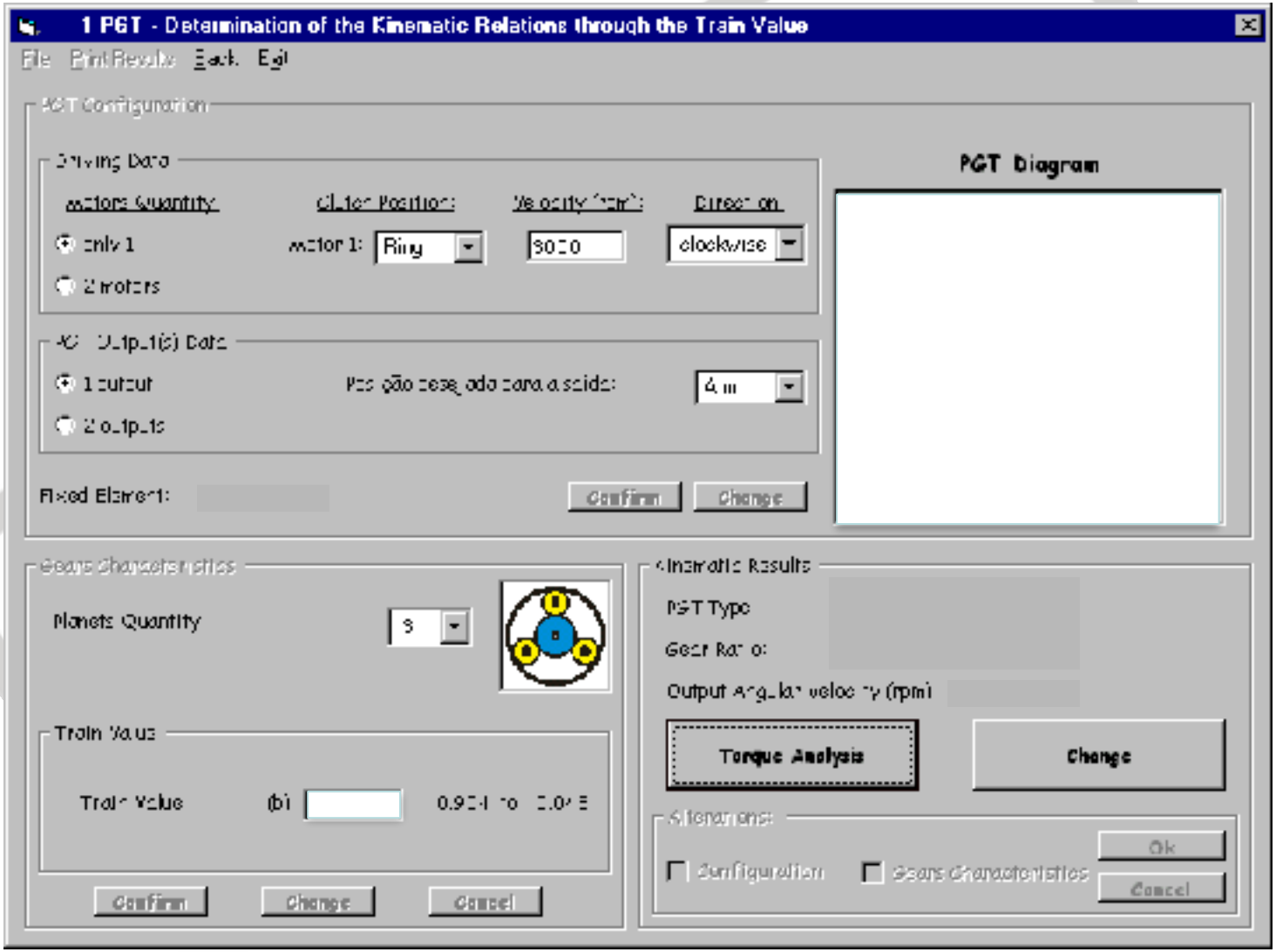

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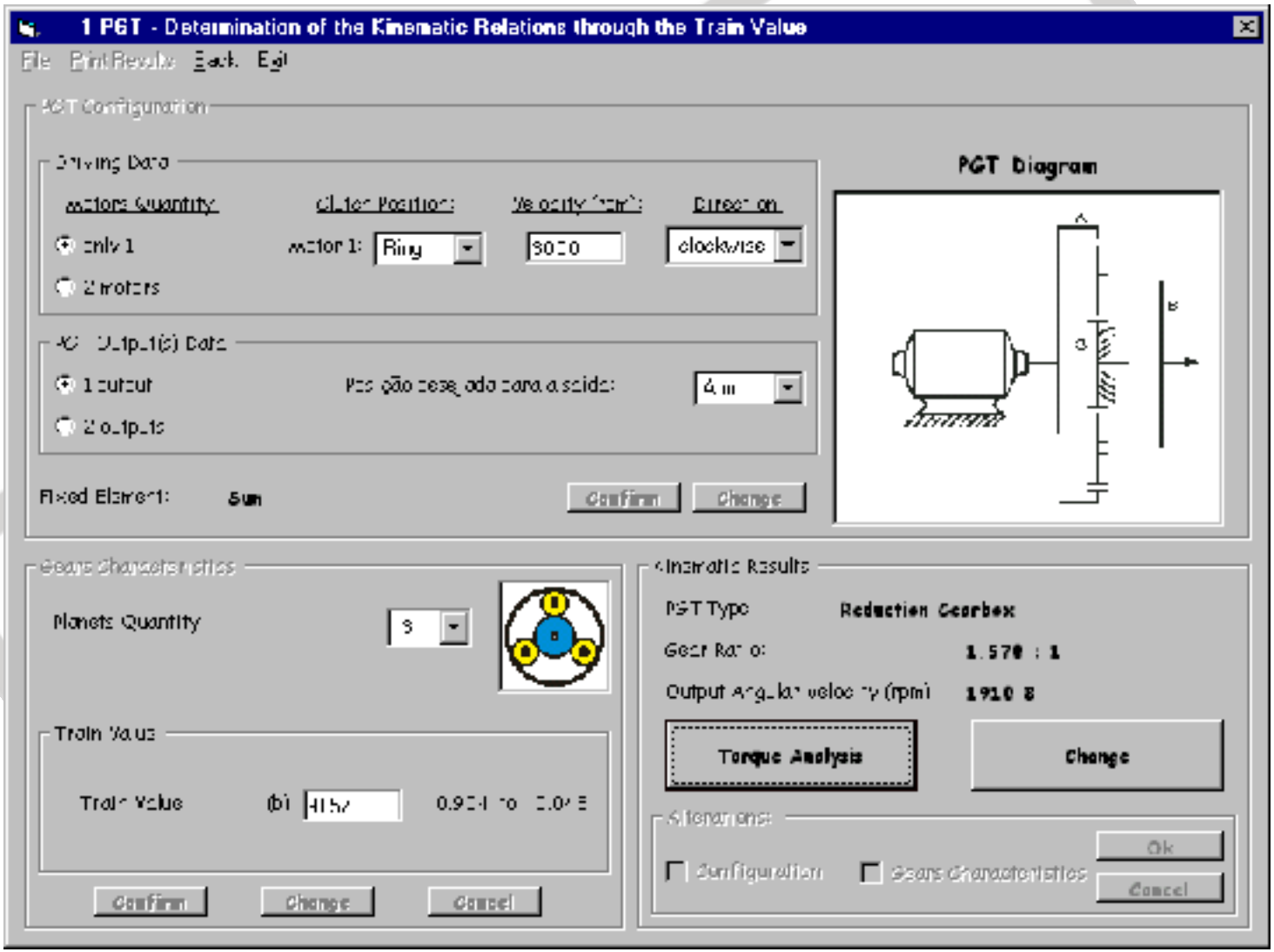

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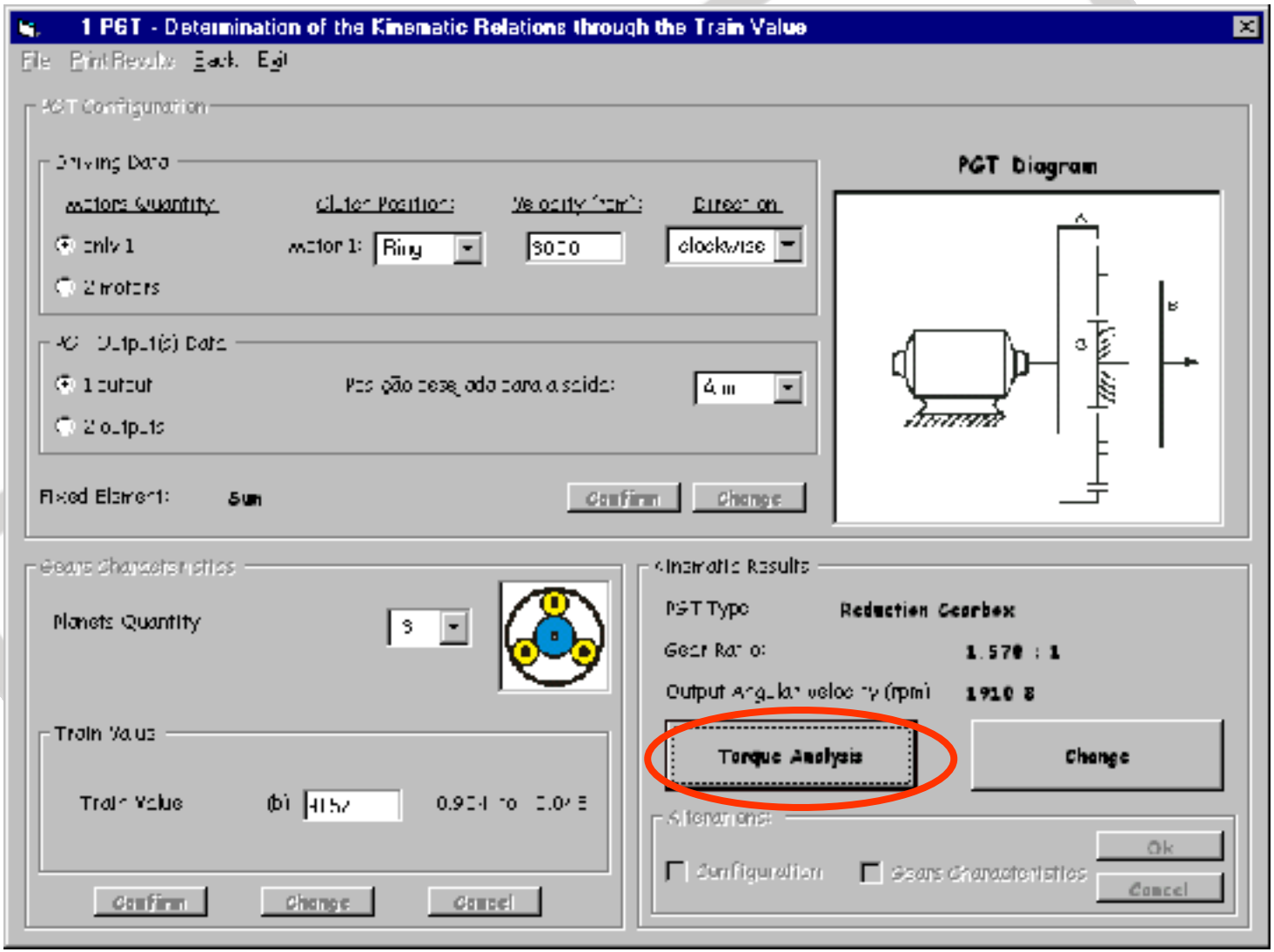

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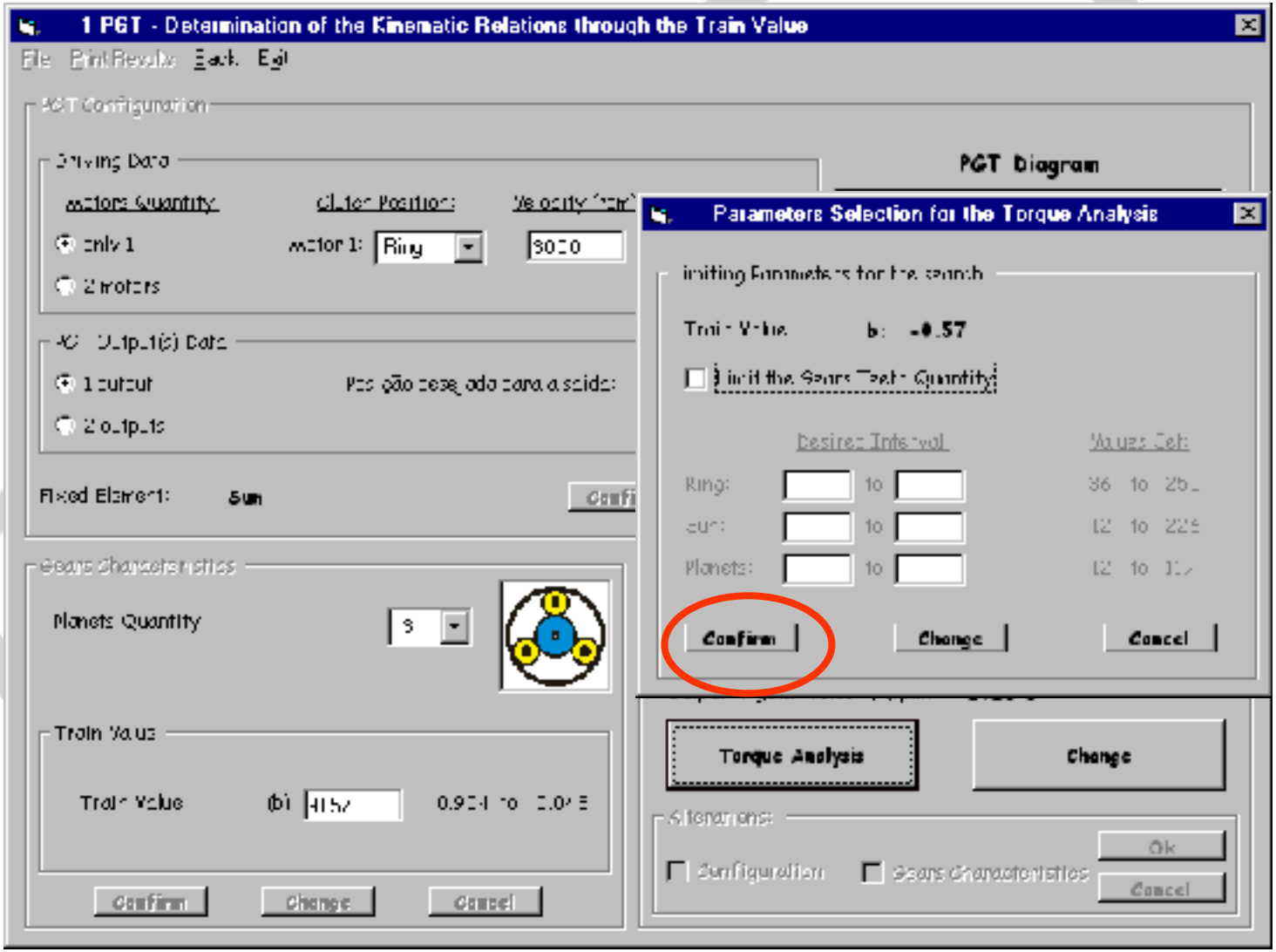

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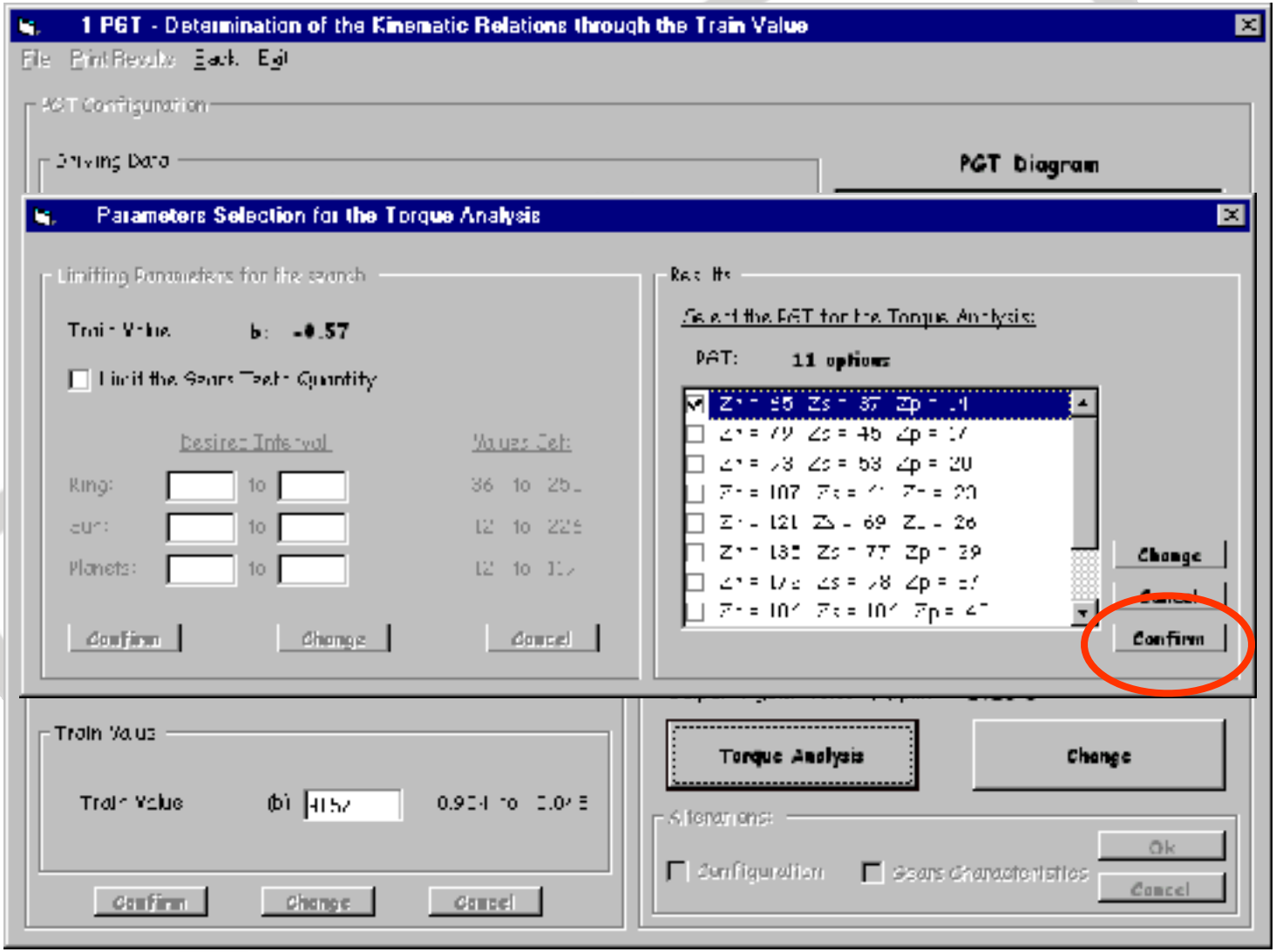

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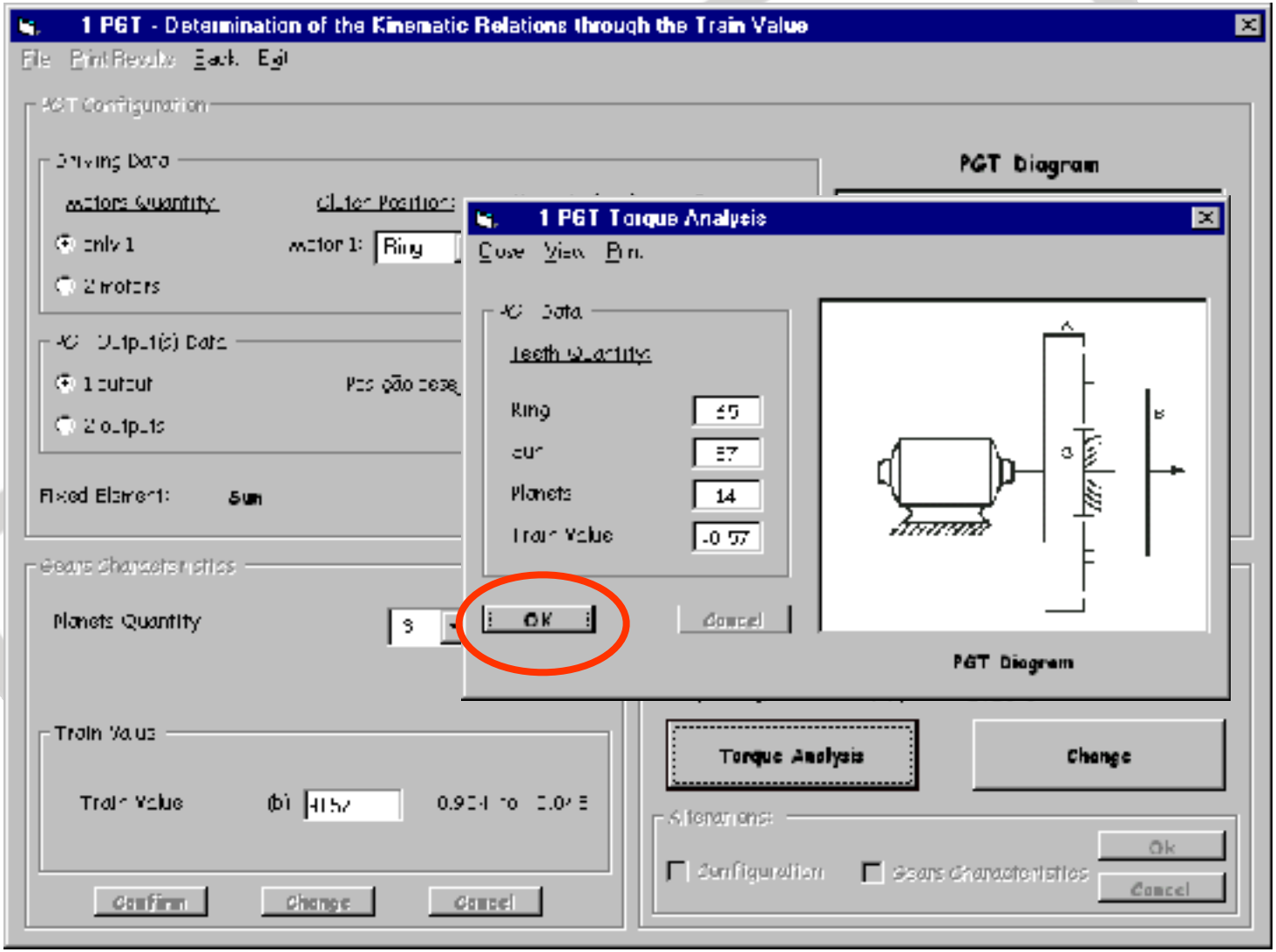

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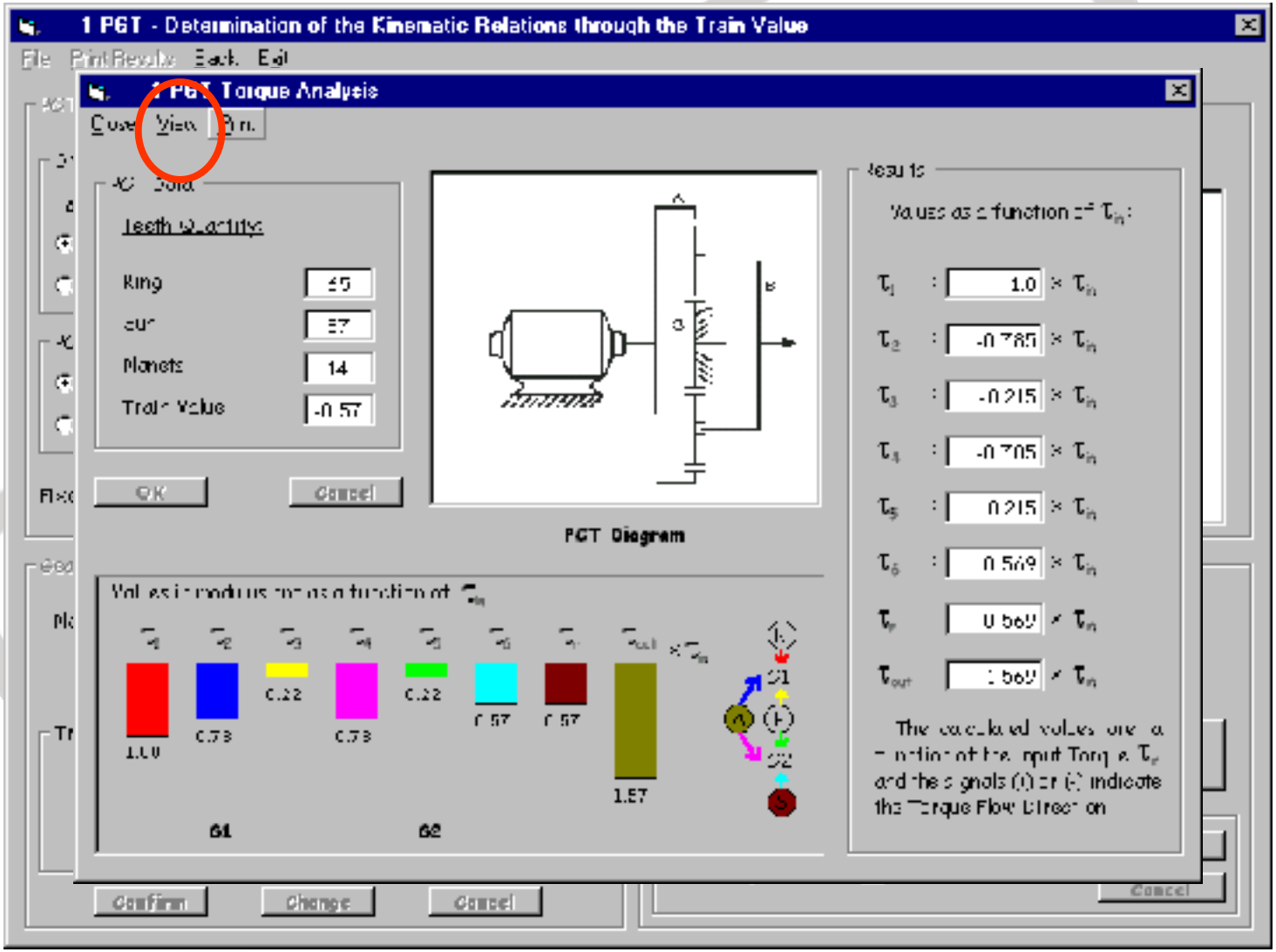

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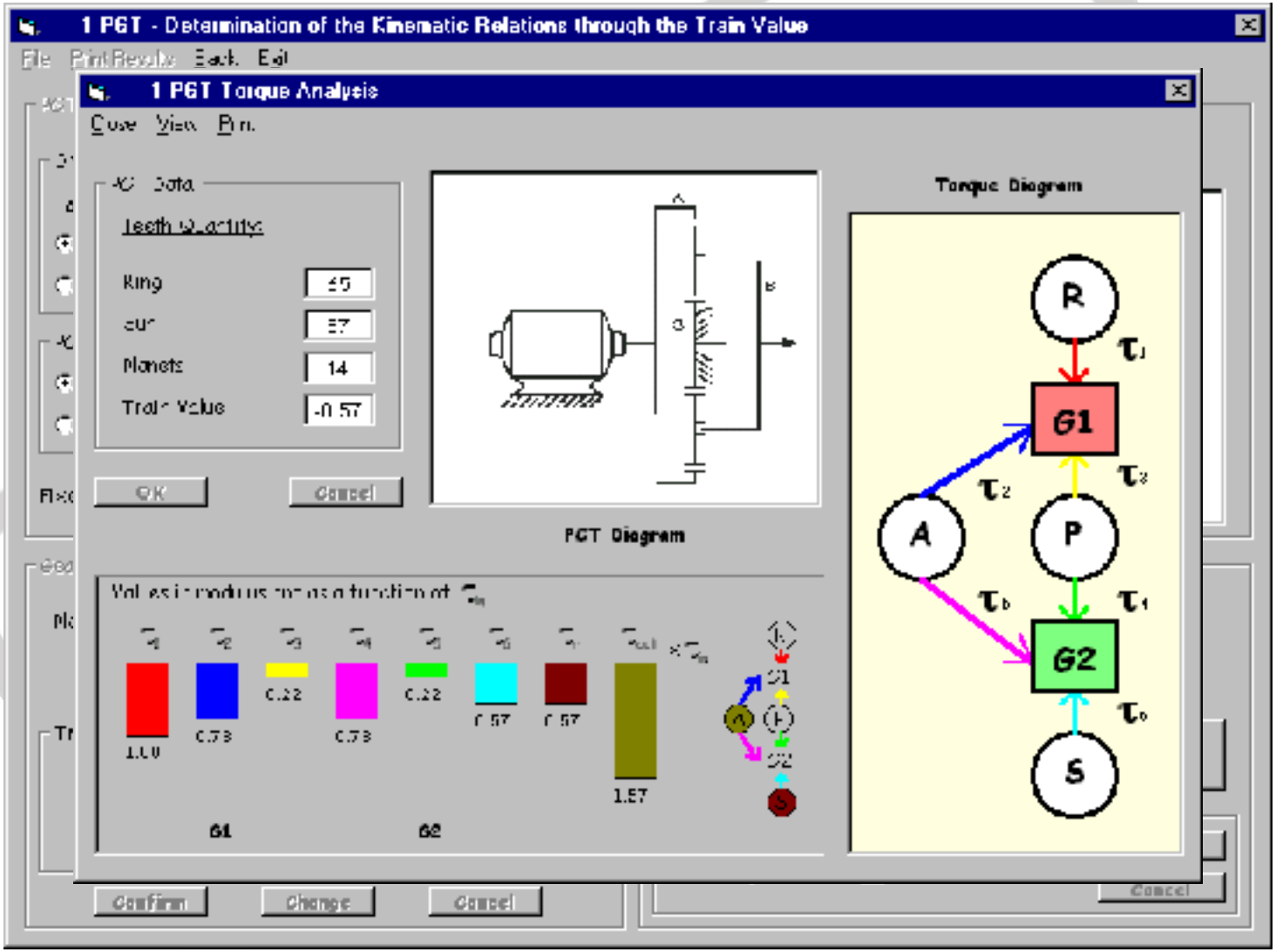

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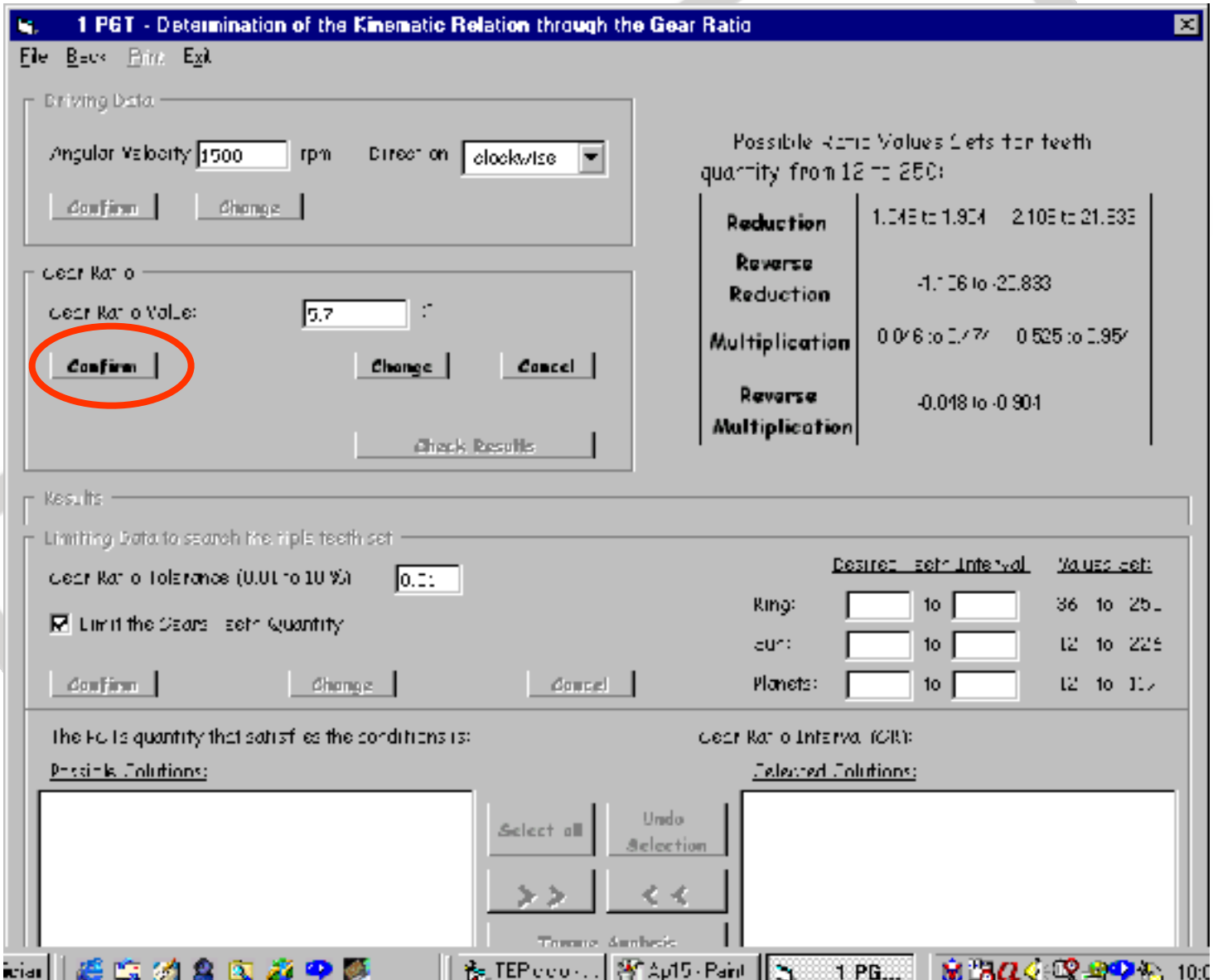
Exemplo 1 TEP: Síntese

Software TEPiciclo – Transmissão



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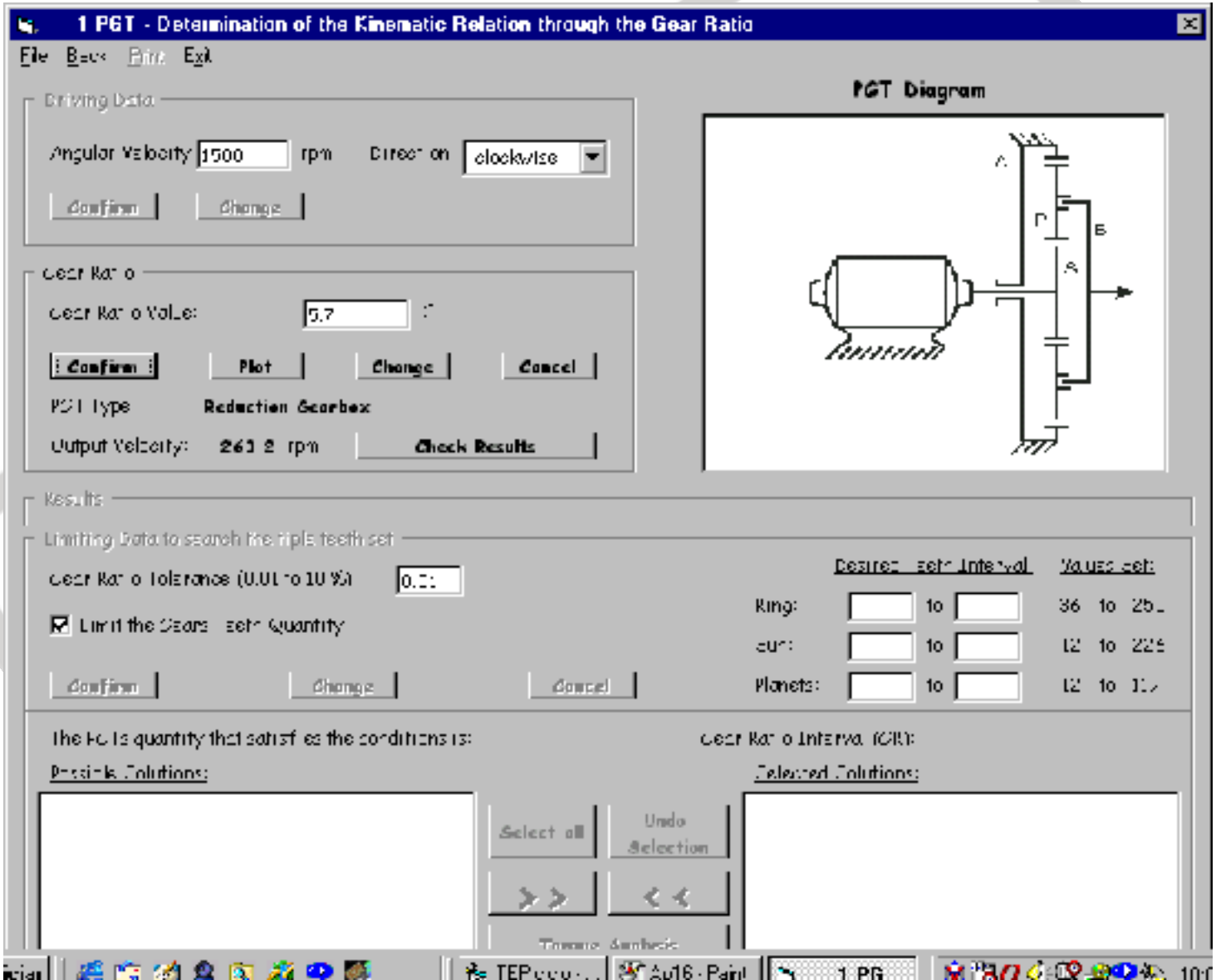

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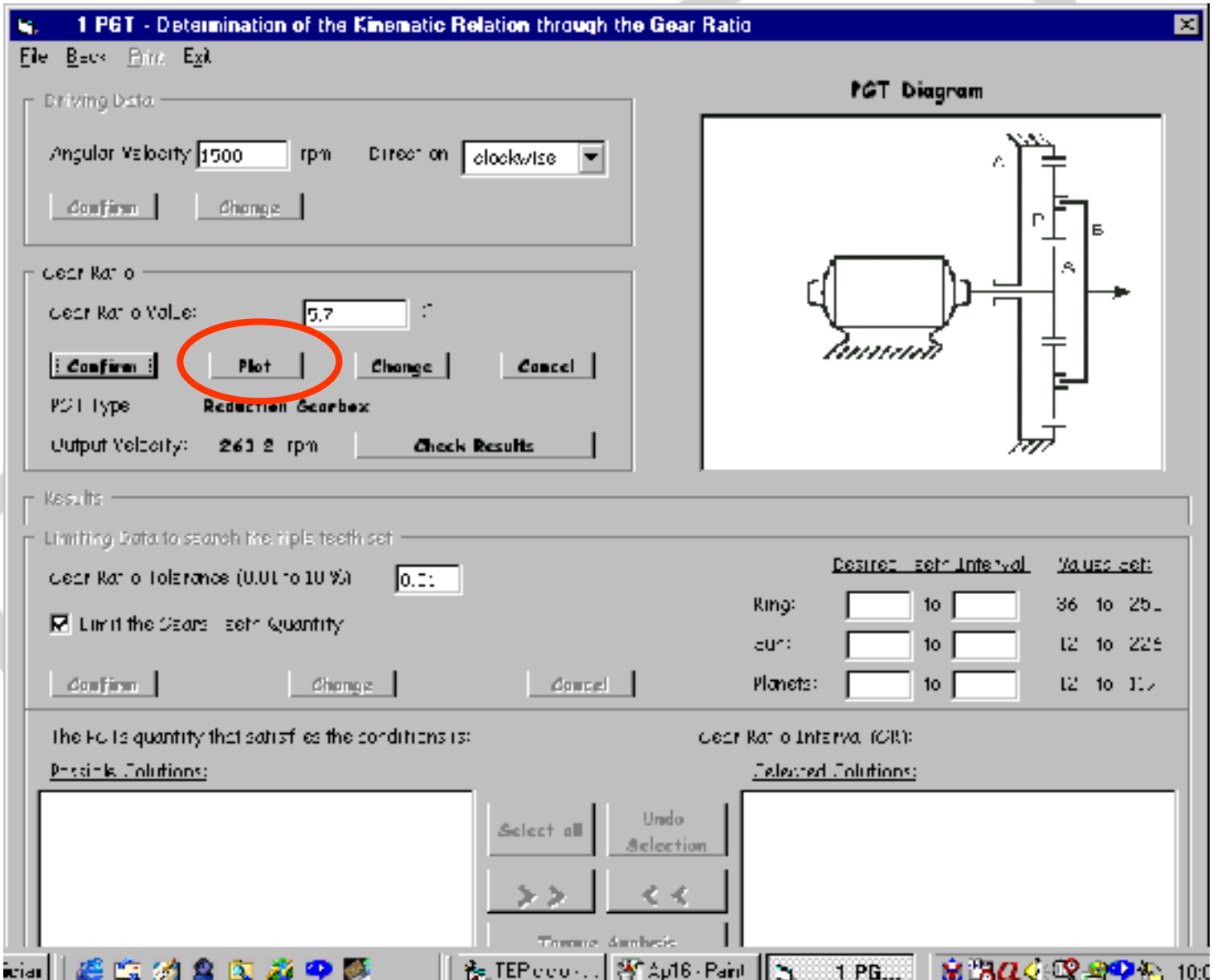

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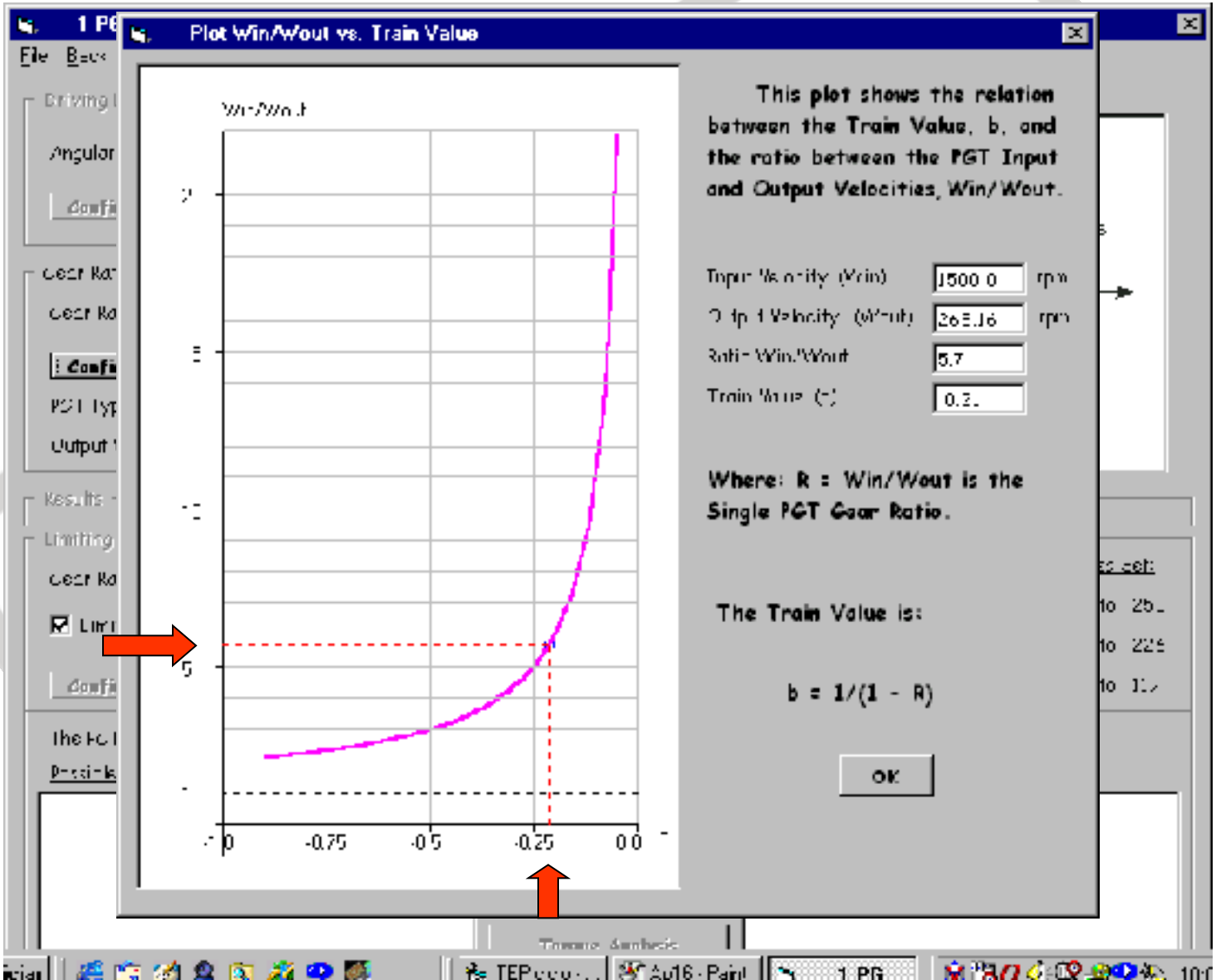

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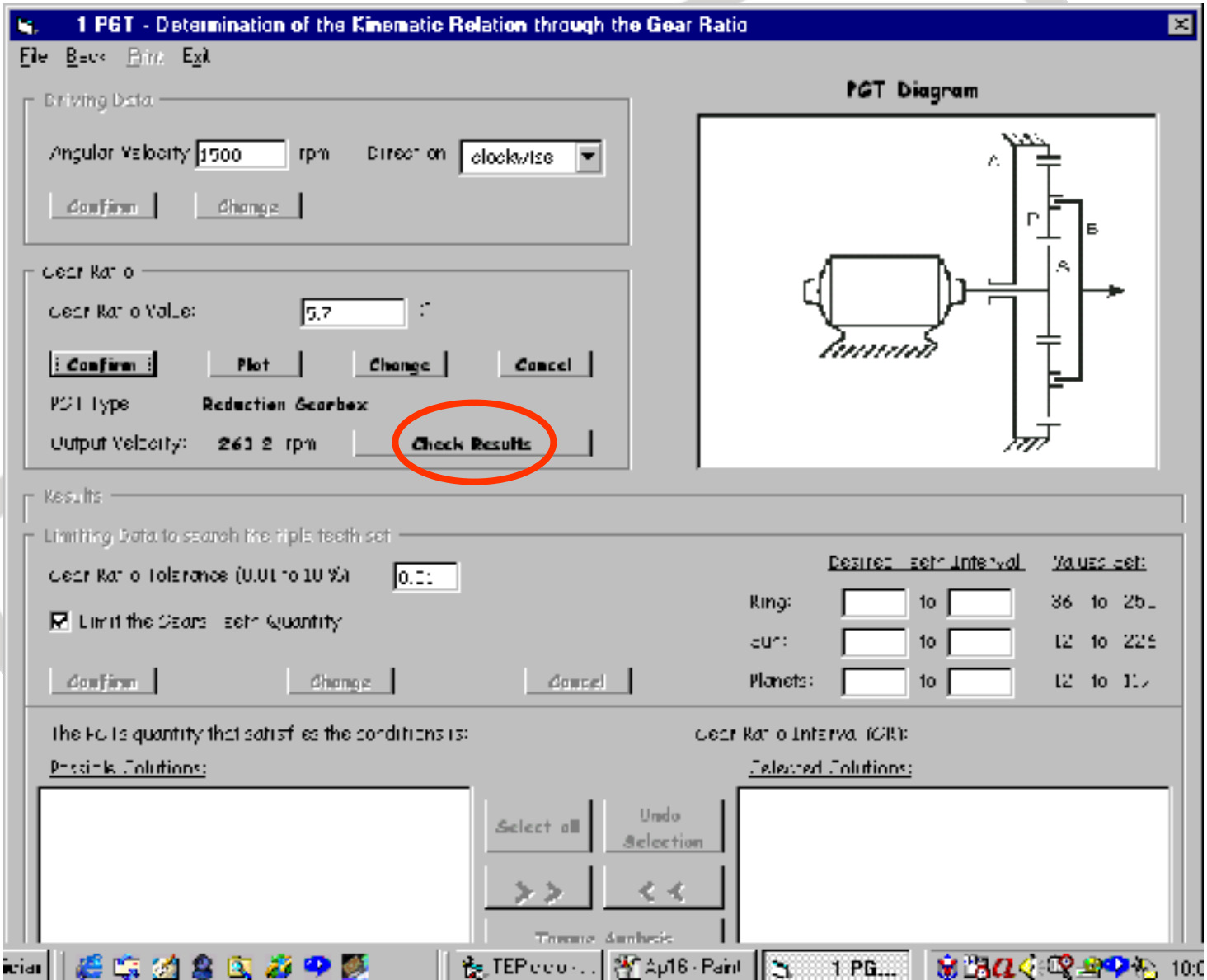

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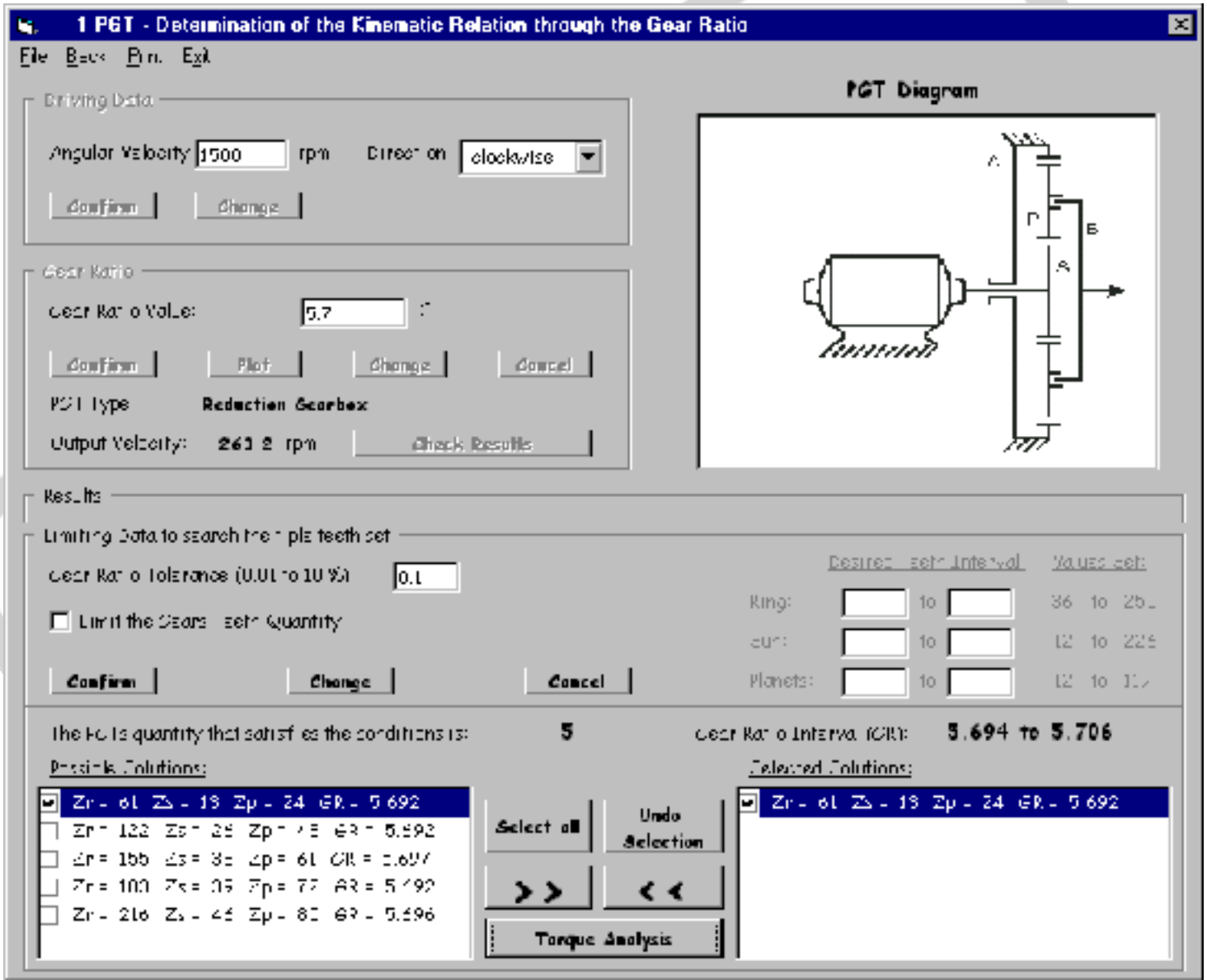

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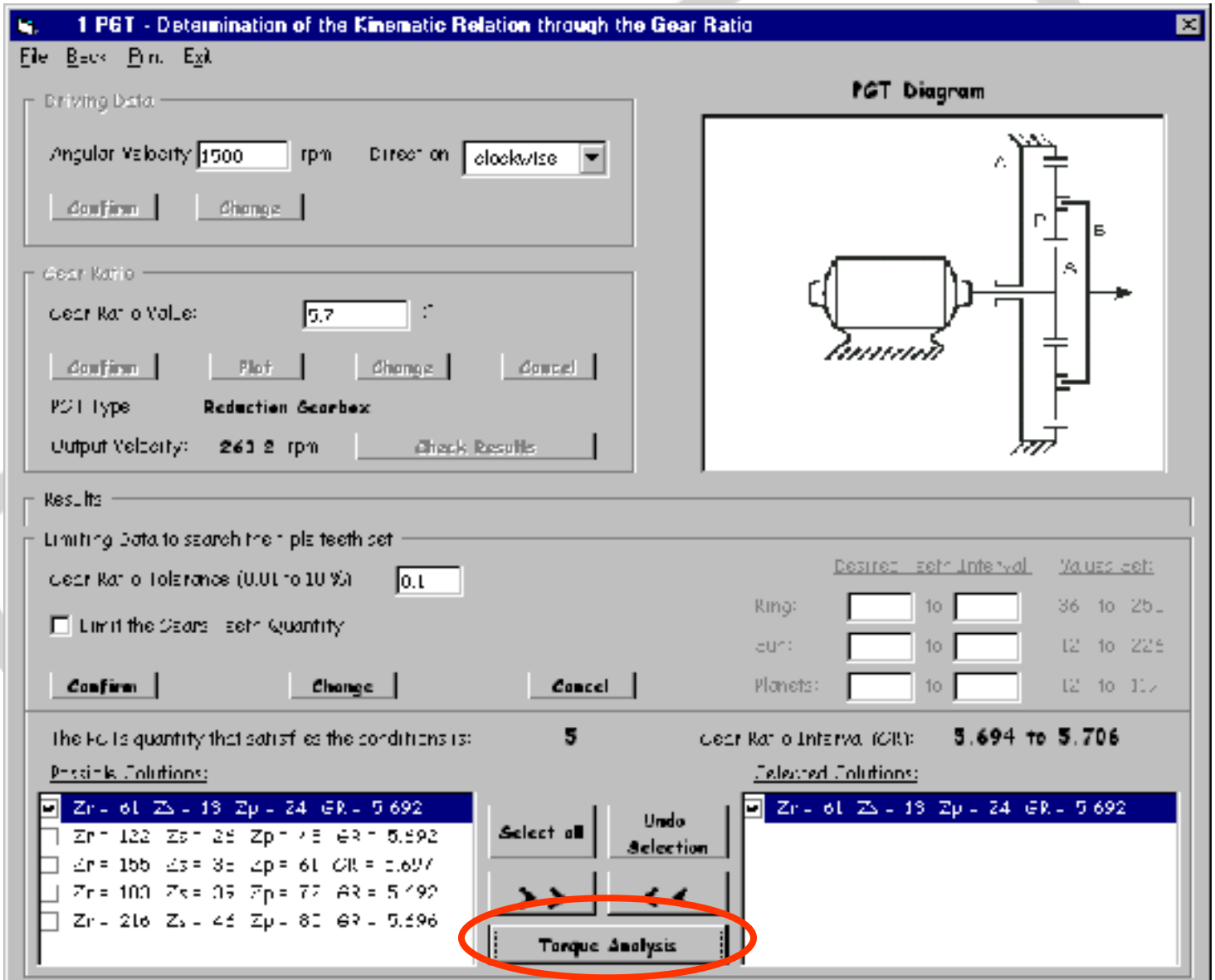

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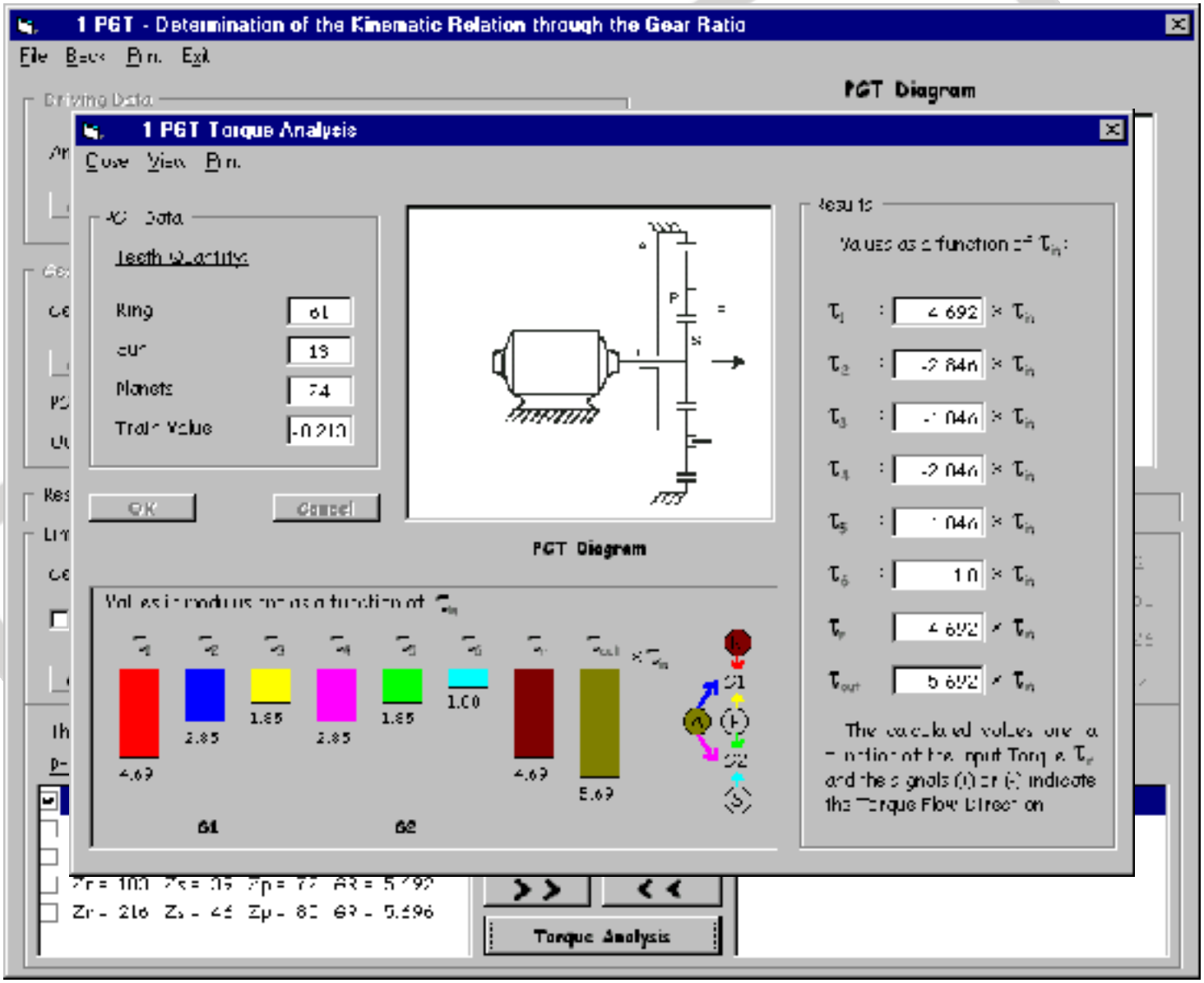

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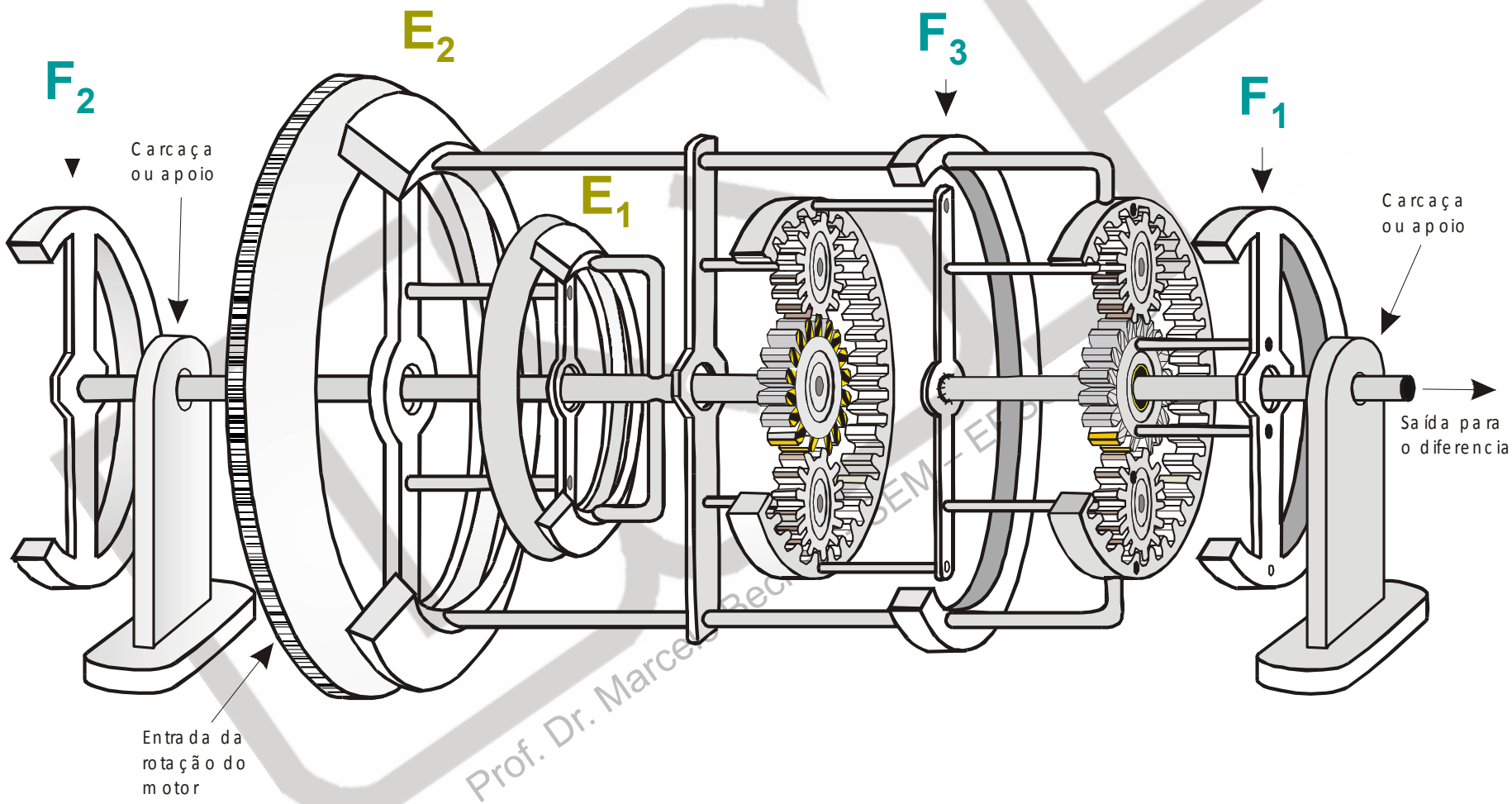
Transmissões Veiculares

Caixa GM HIDRA-MATIC THM – 440 PGT



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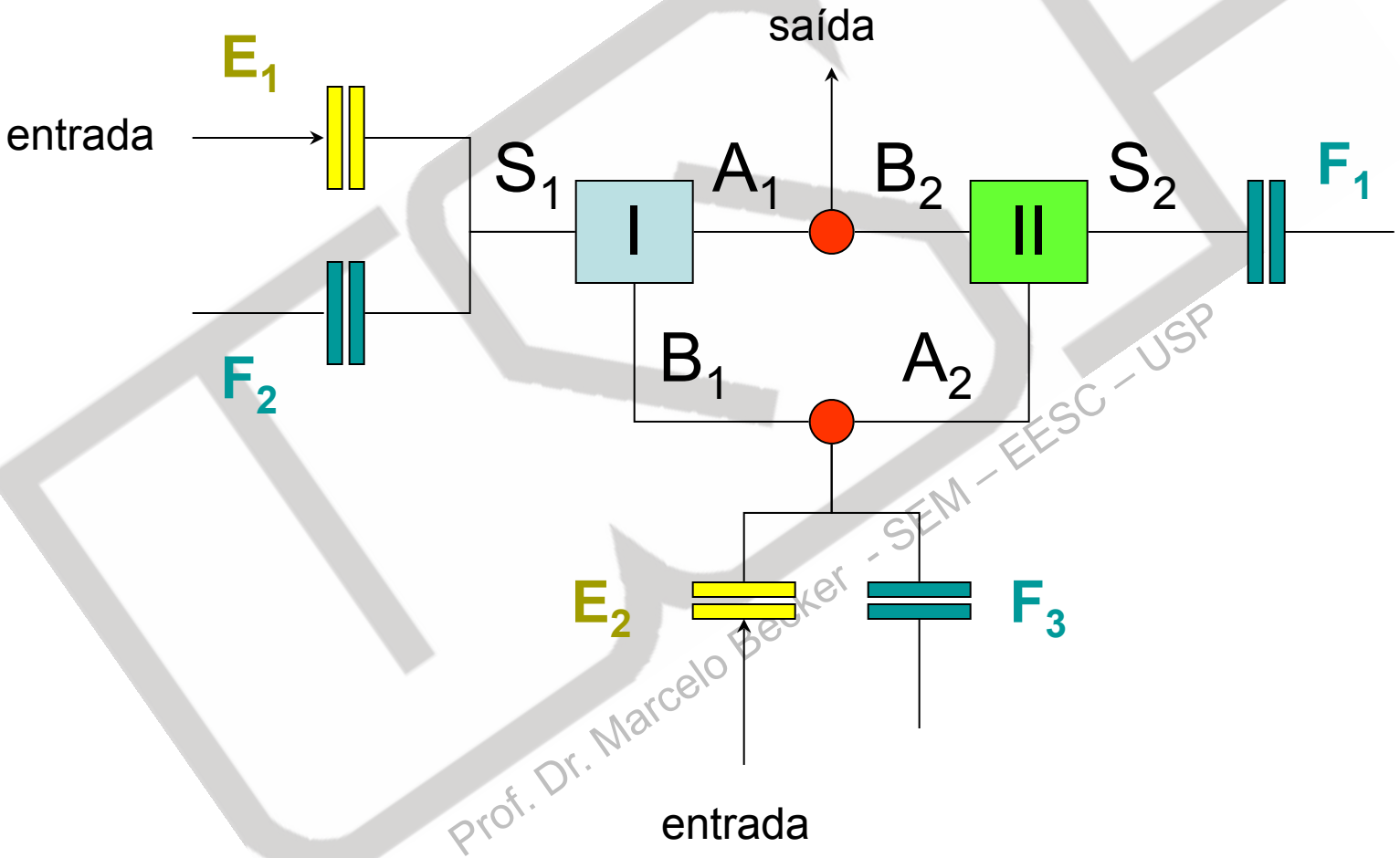

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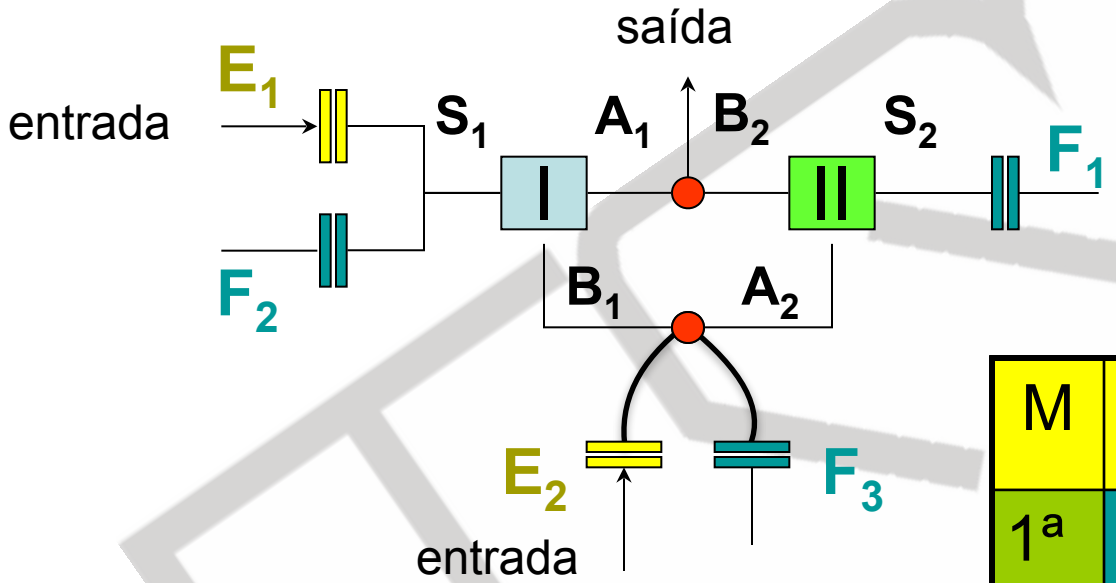

	Z_S	Z_P	Z_A
TEP I	26	18	62
TEP II	42	16	74

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

Exemplo 2 TEPs: Análise

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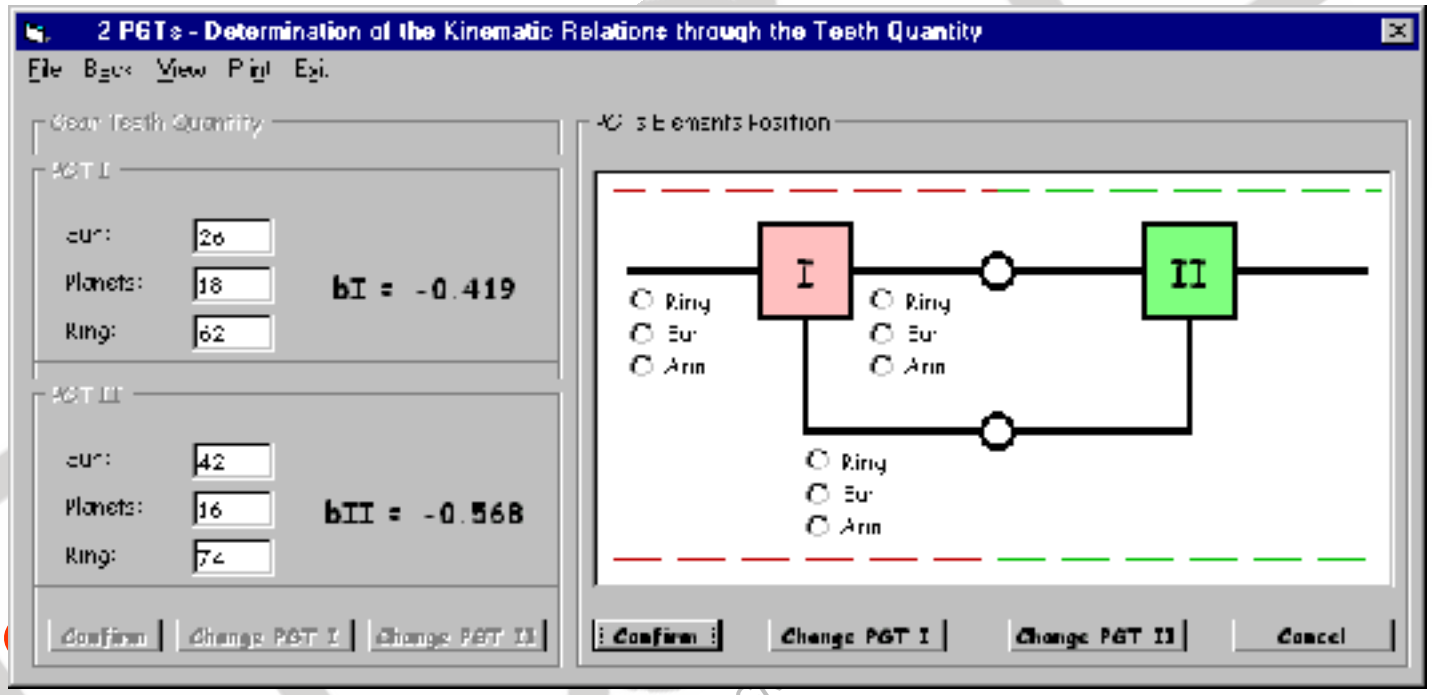

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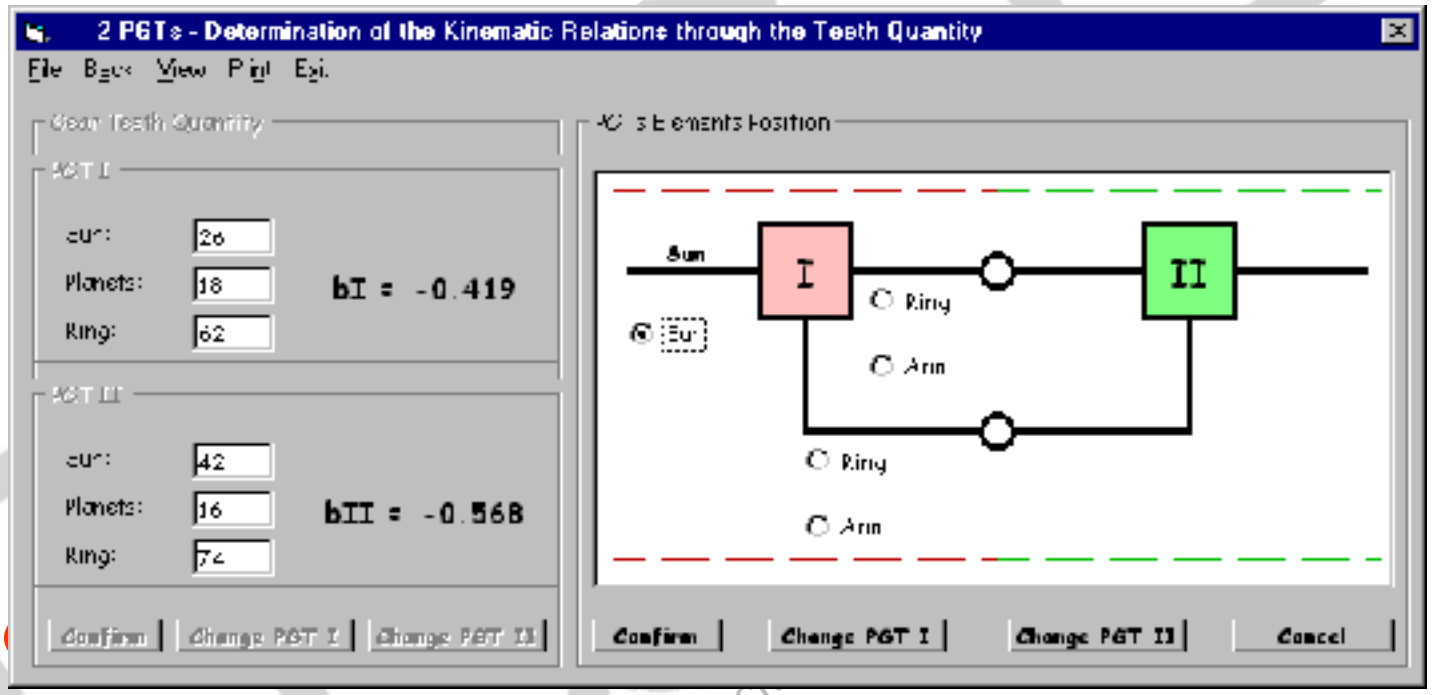

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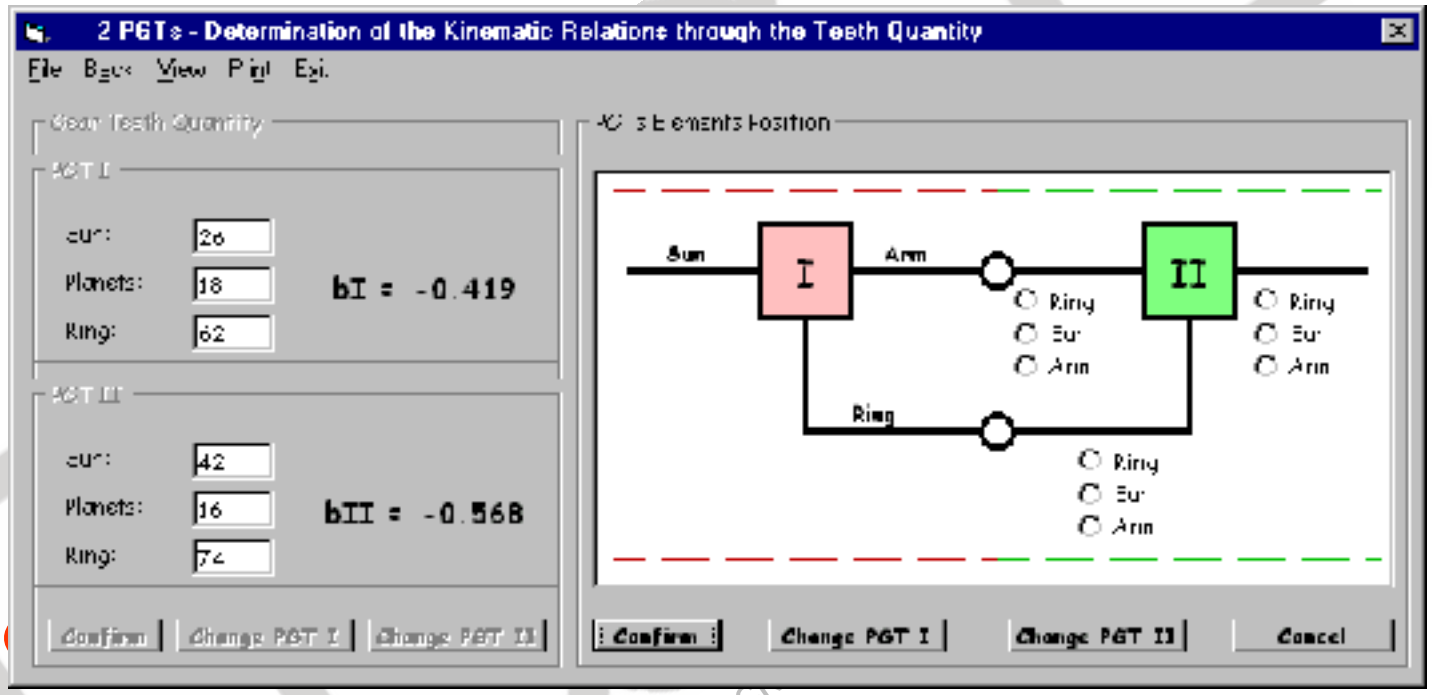

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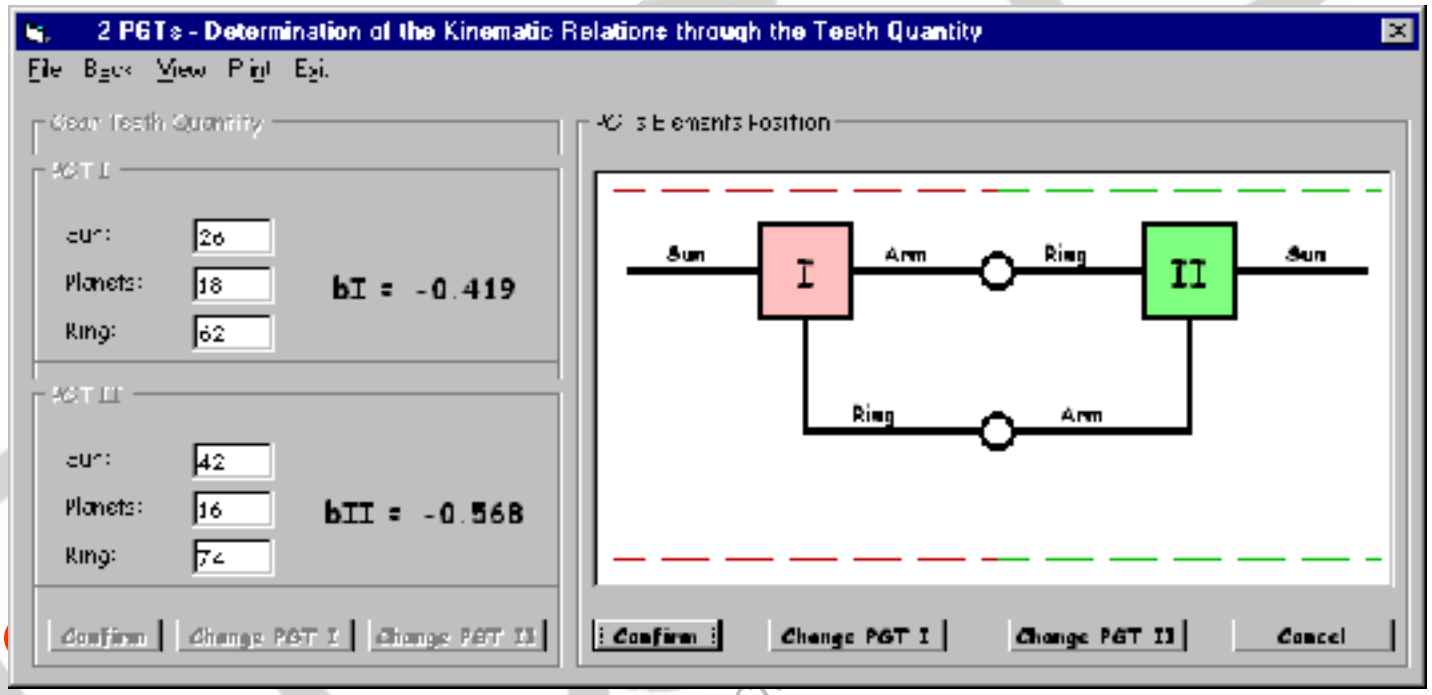

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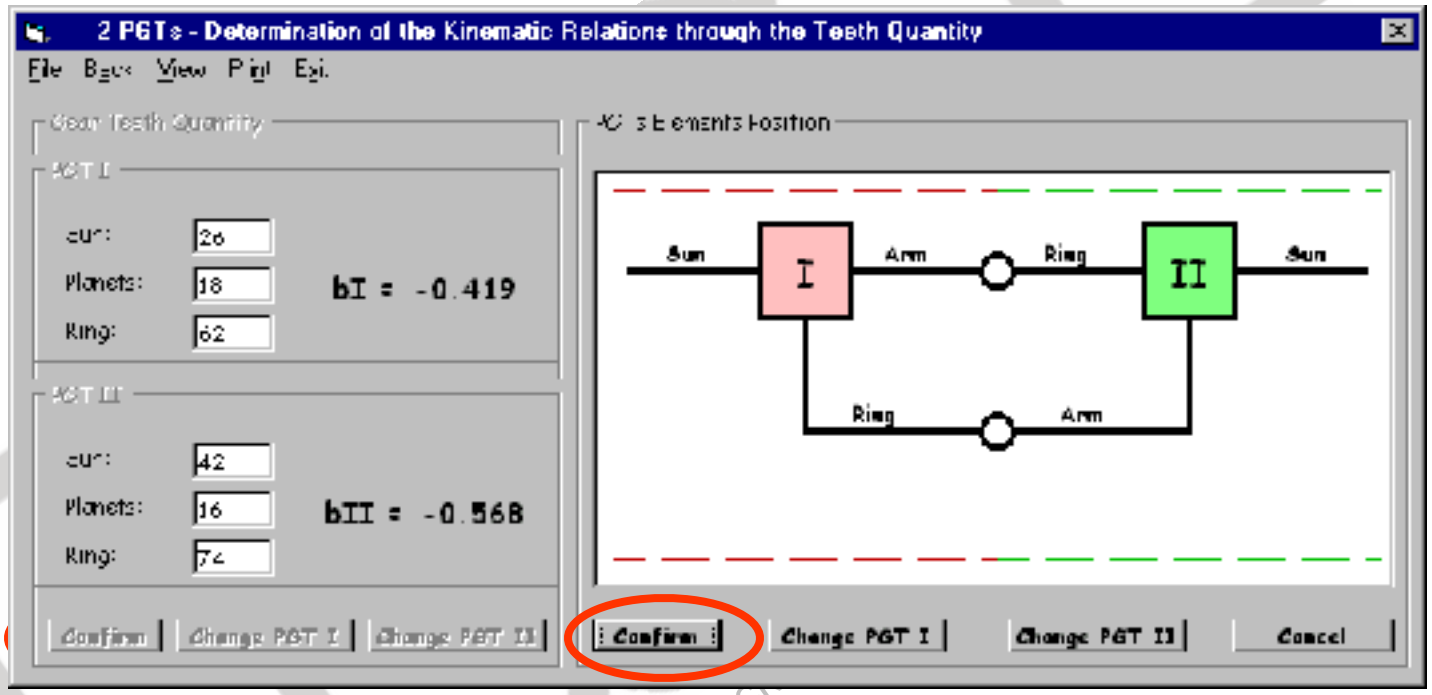

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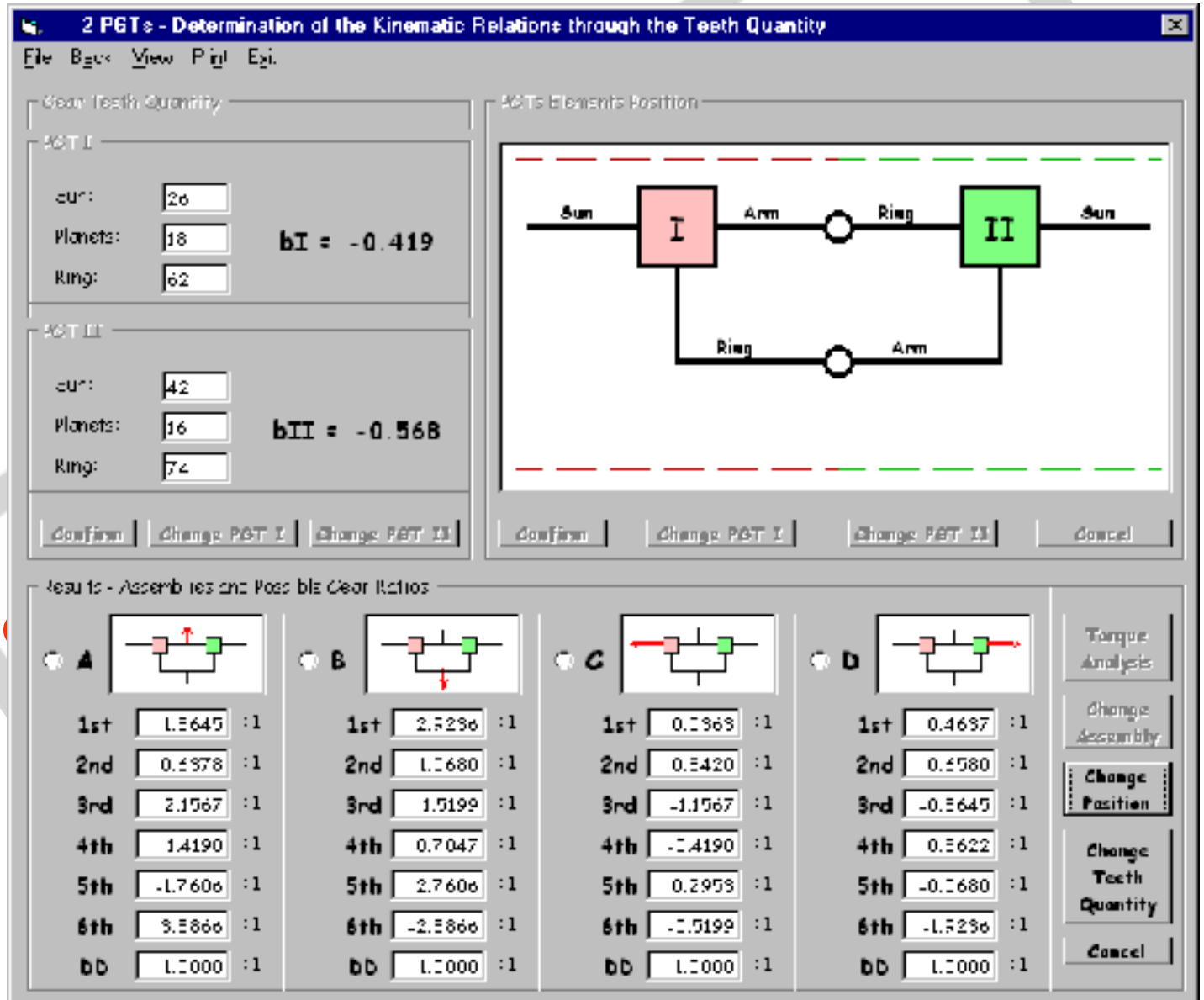

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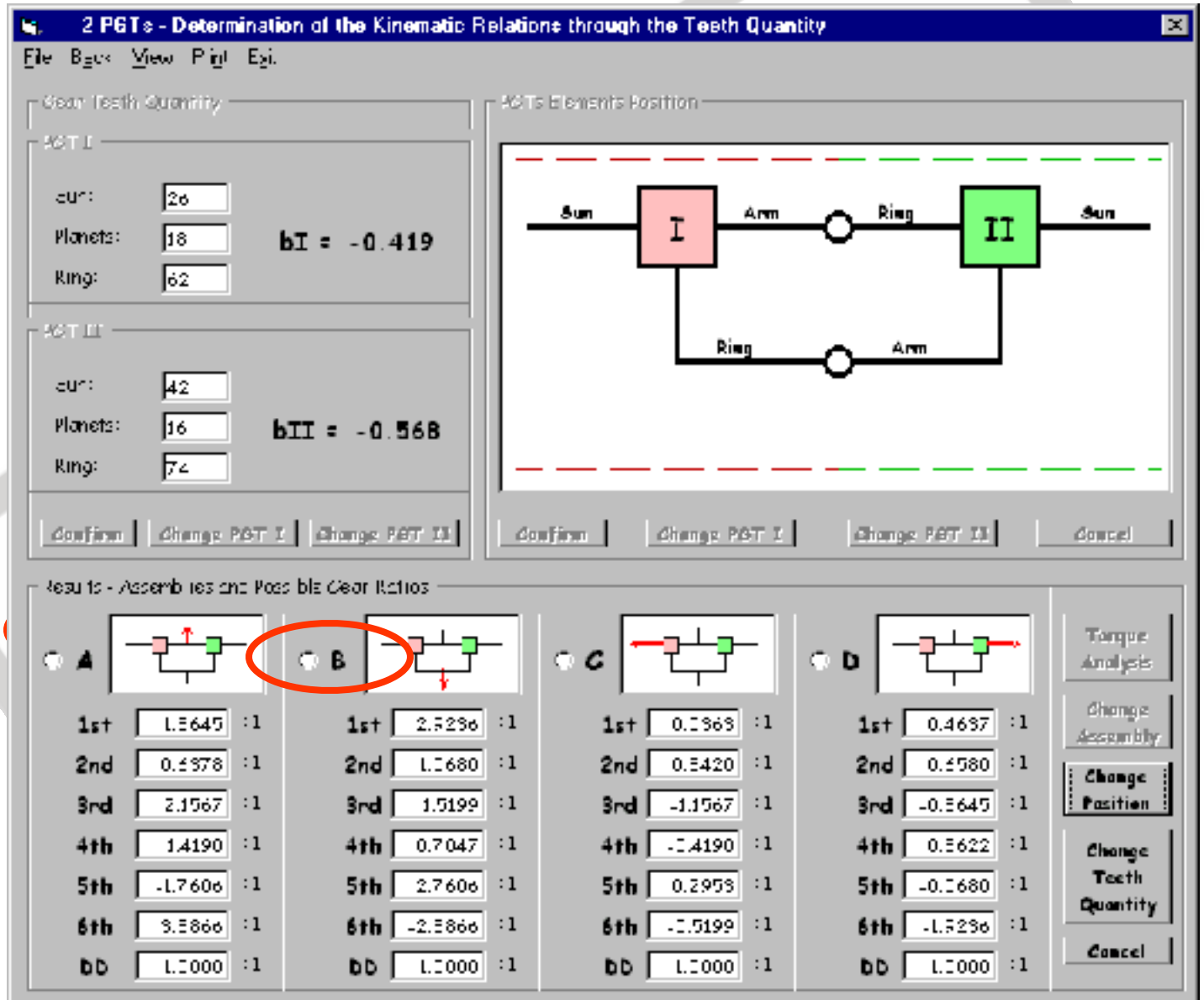

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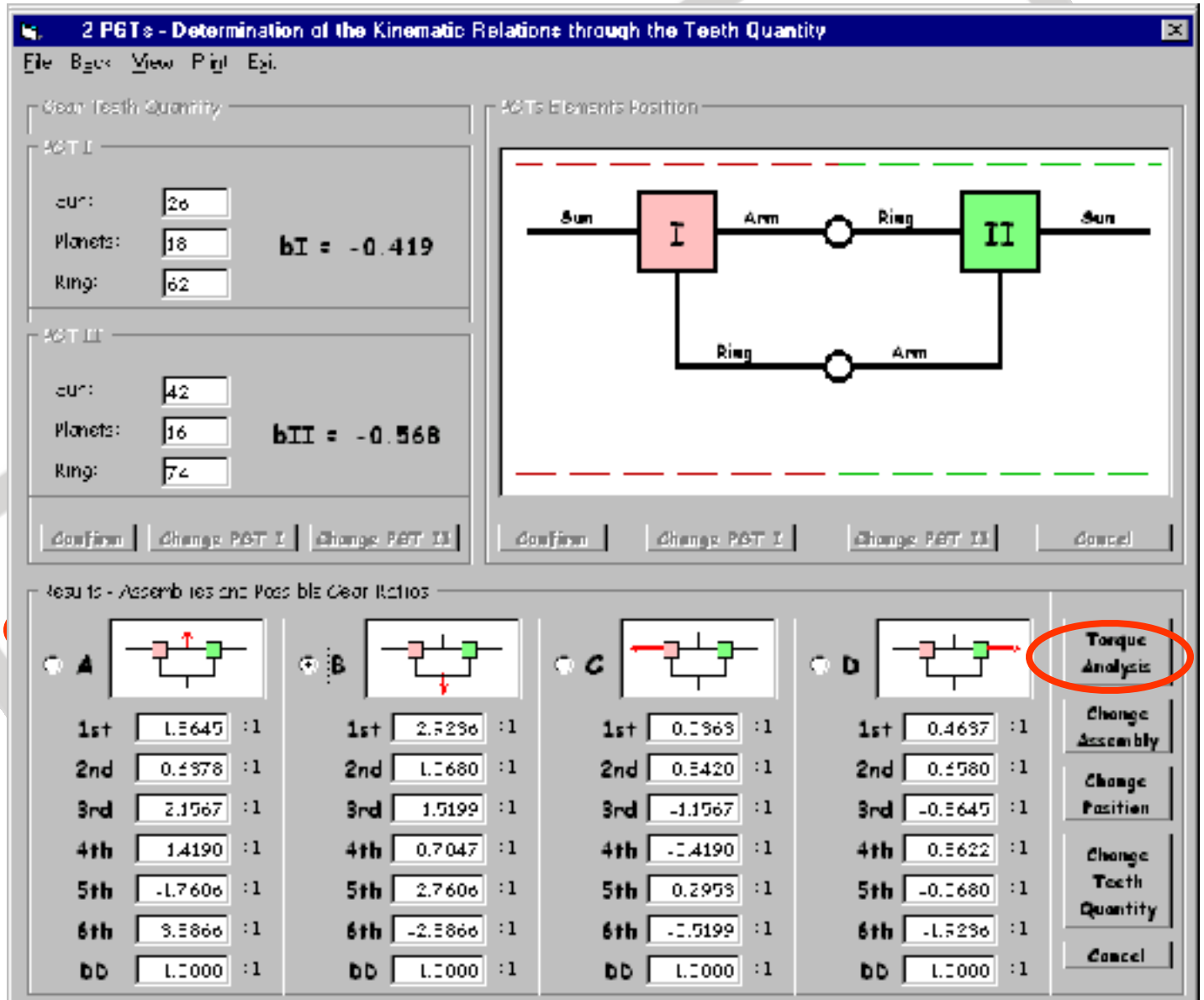

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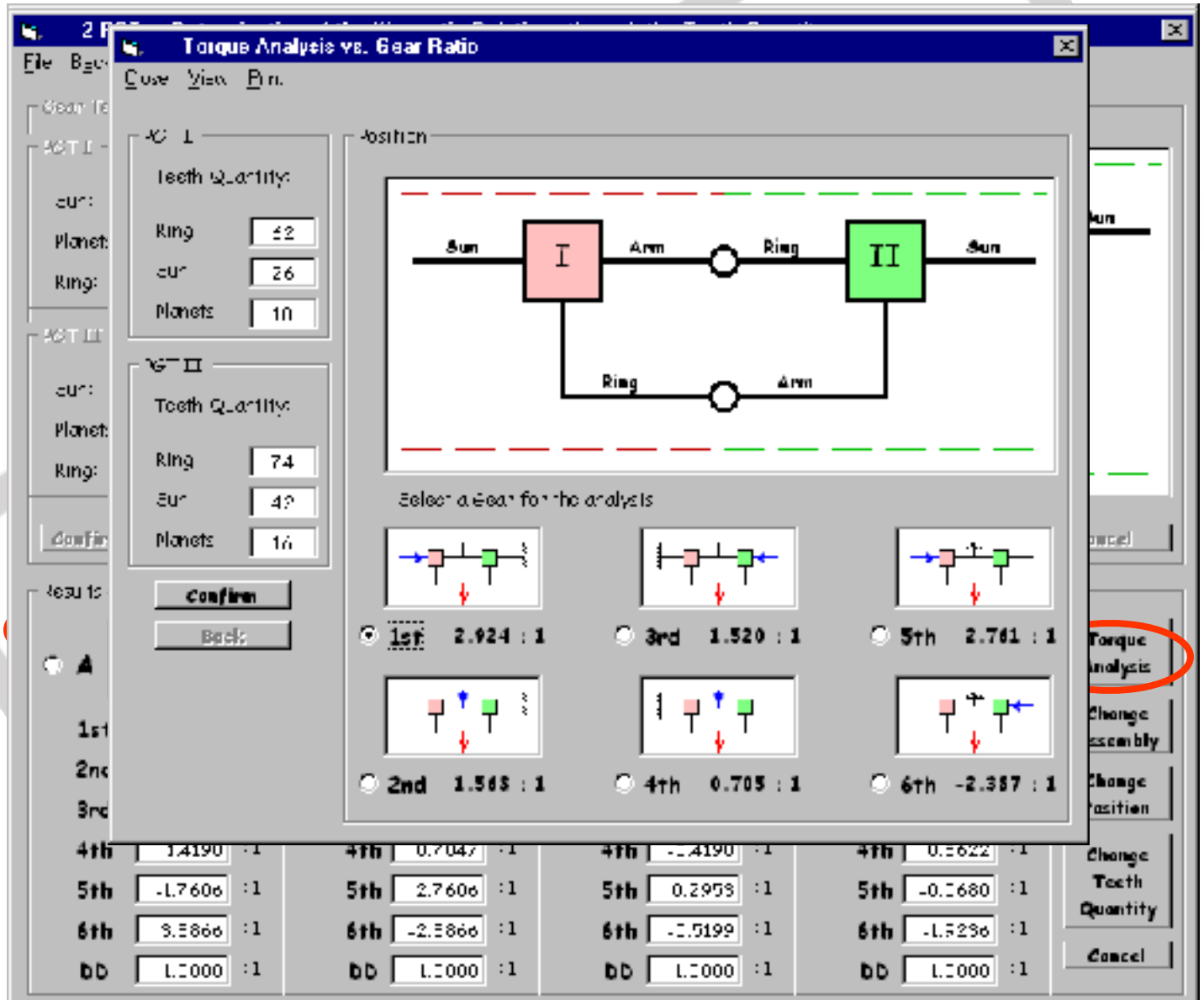

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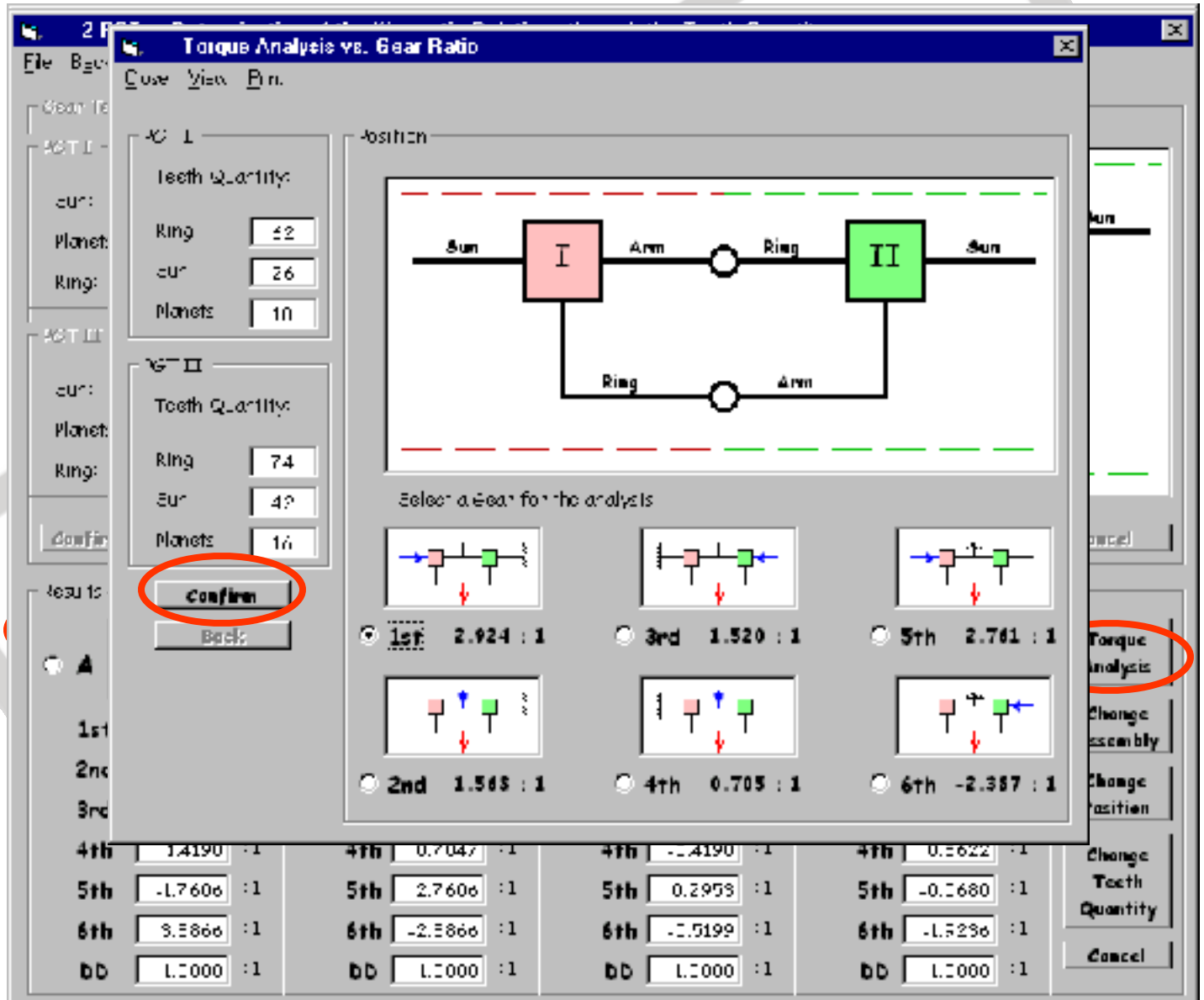

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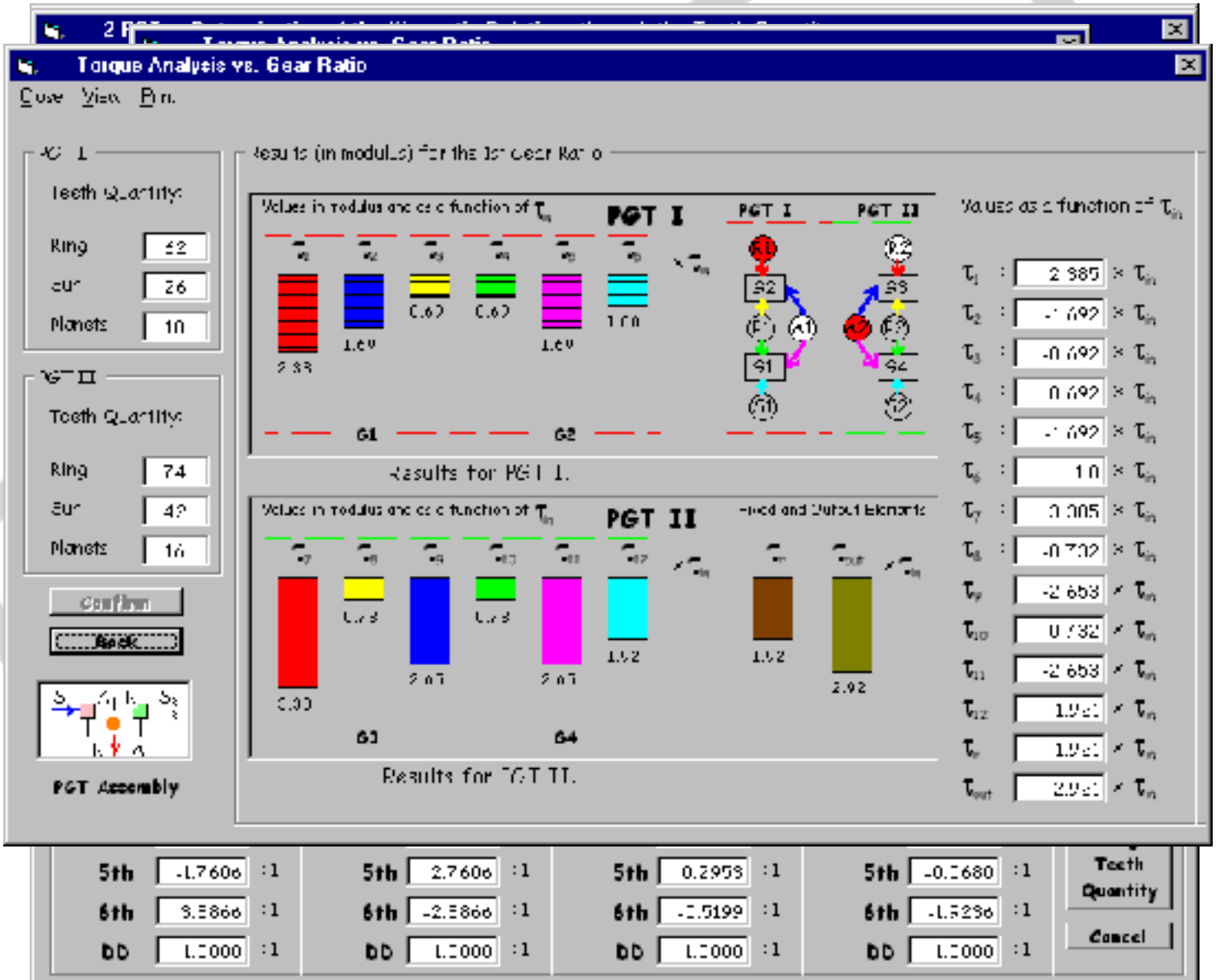

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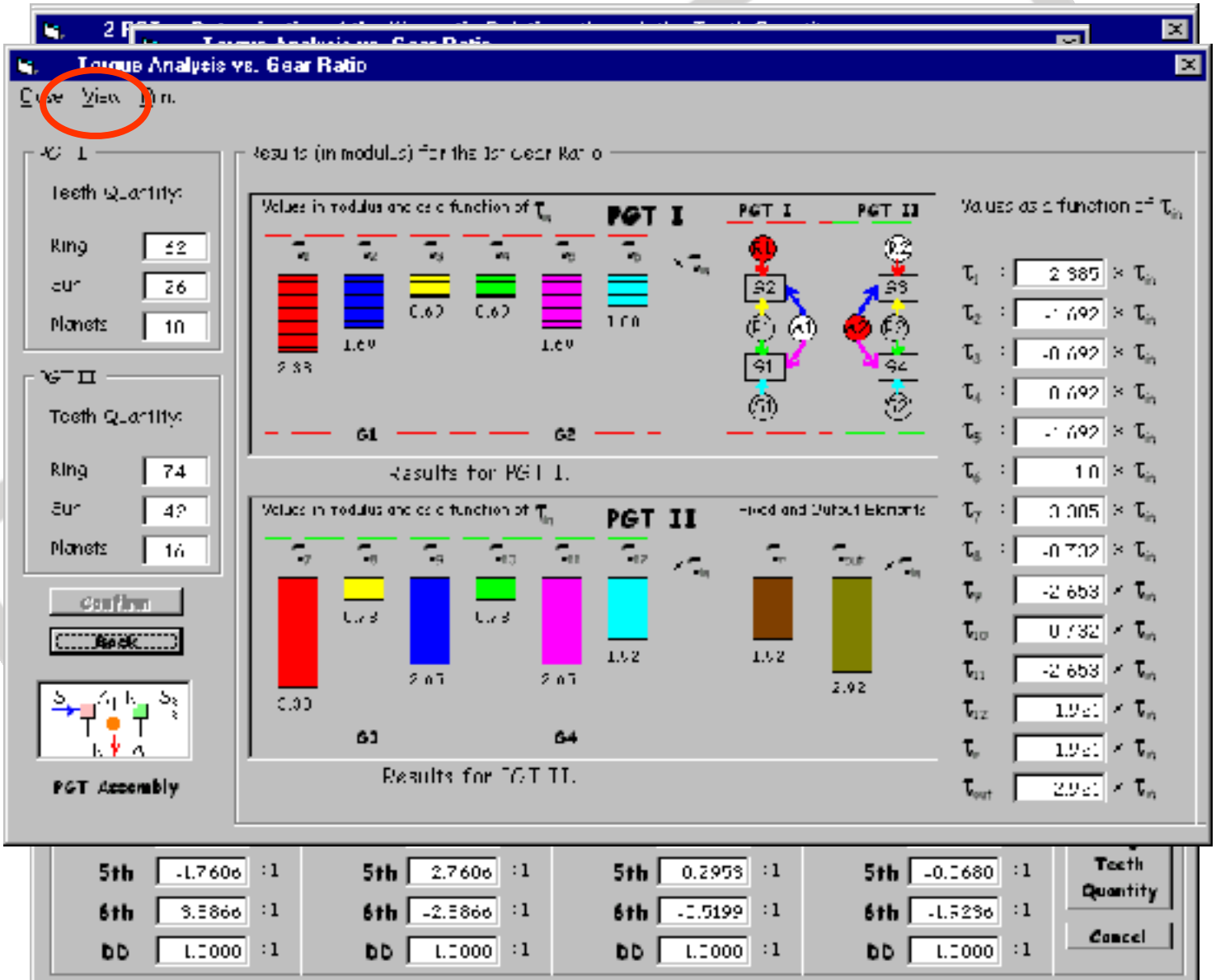

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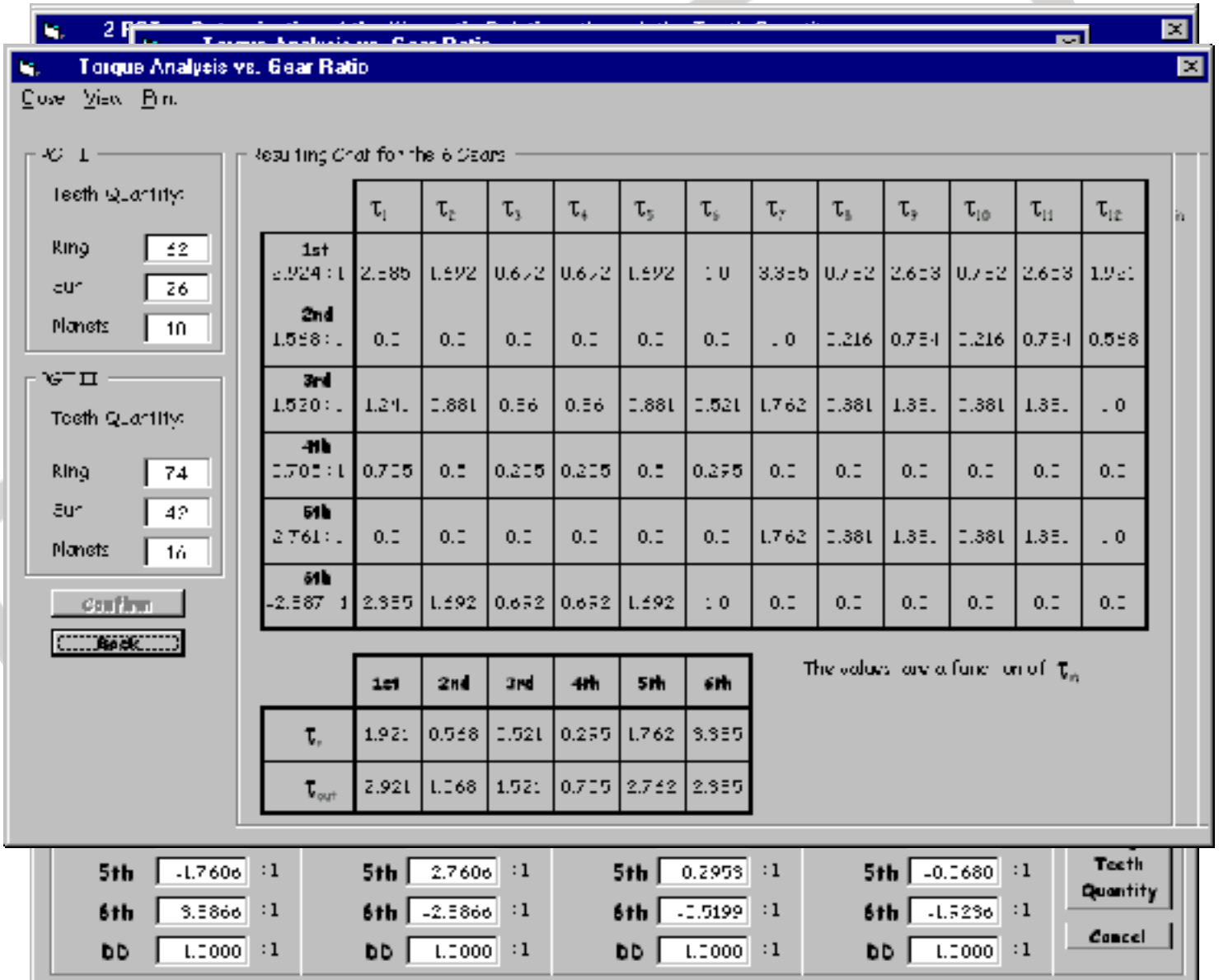

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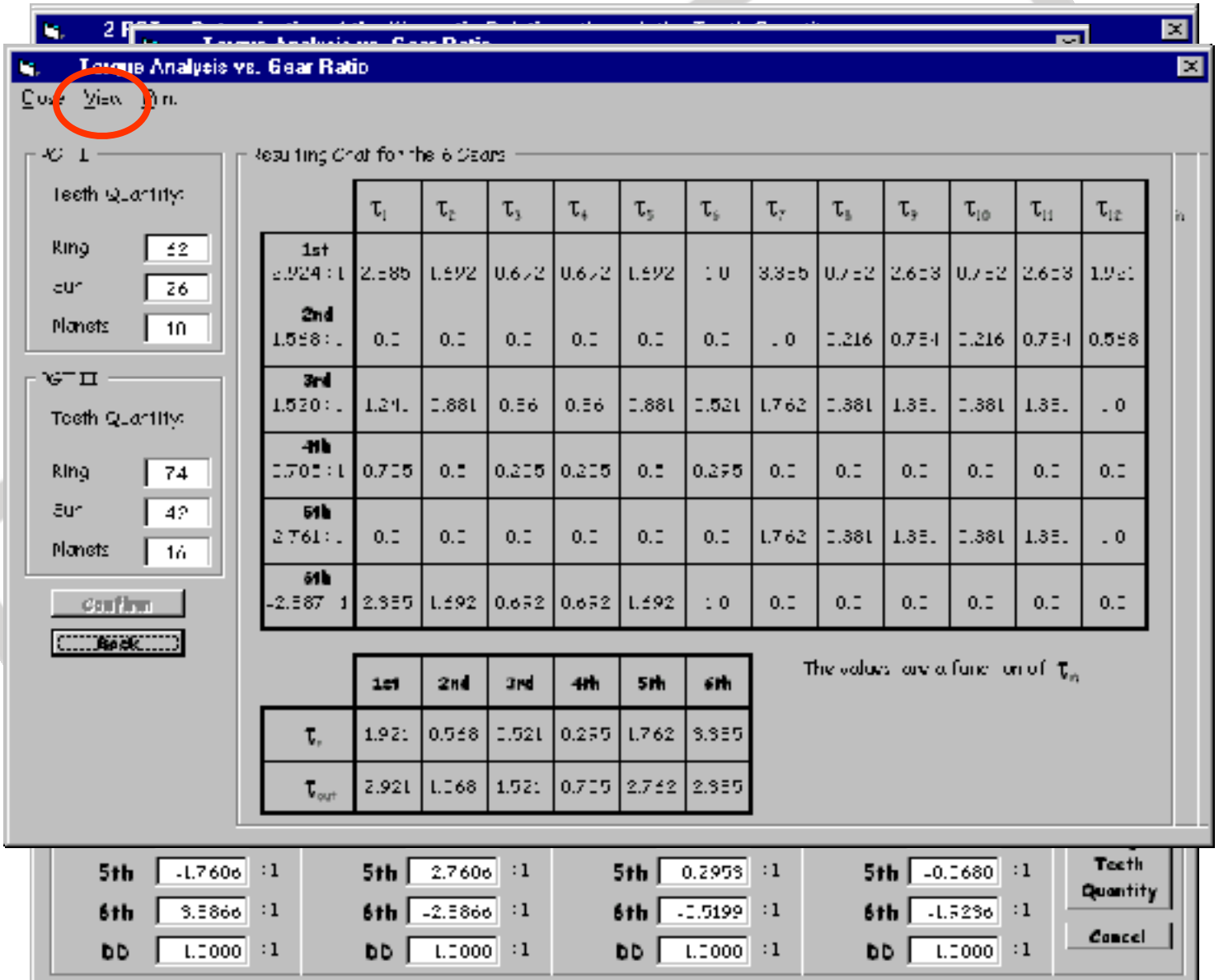

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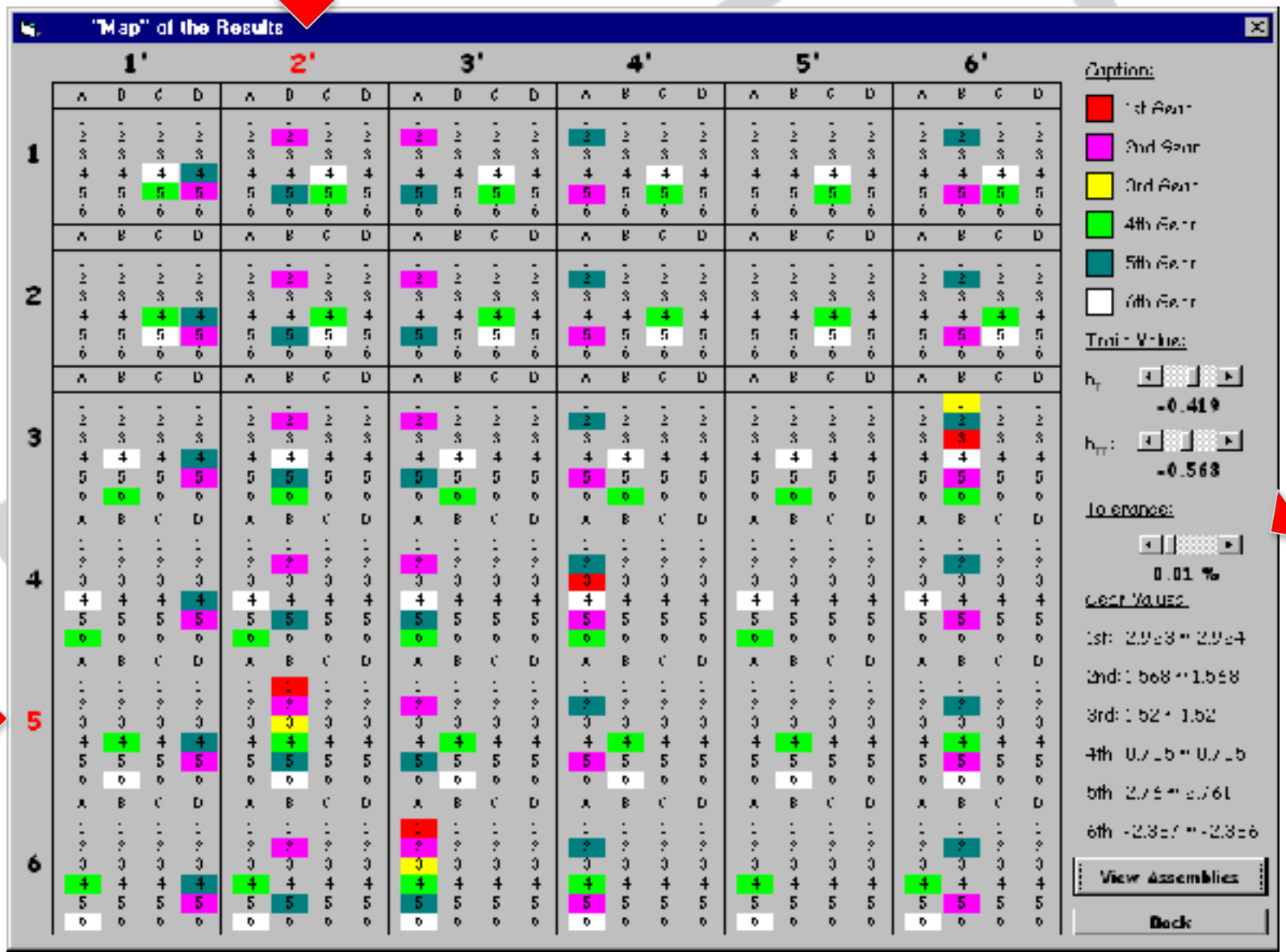

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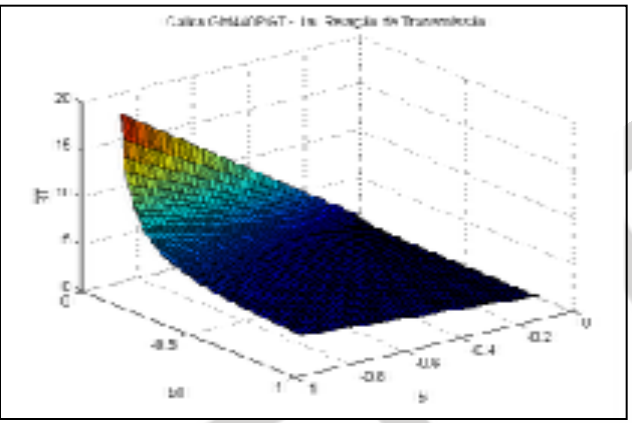
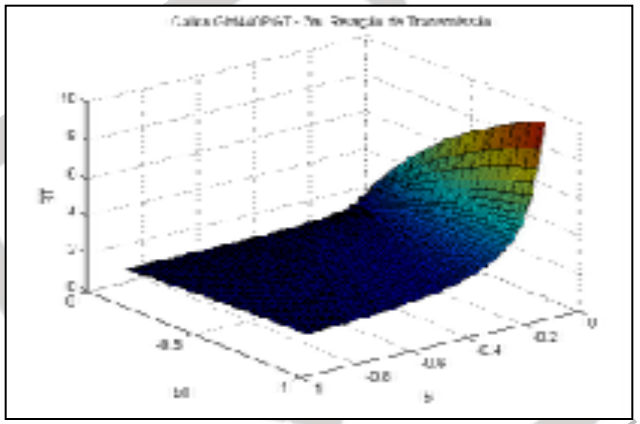
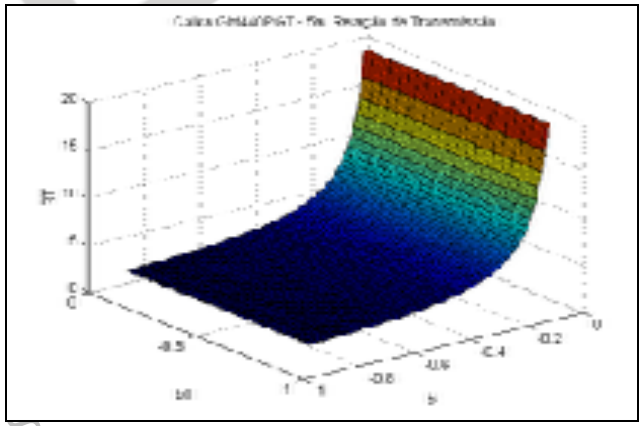
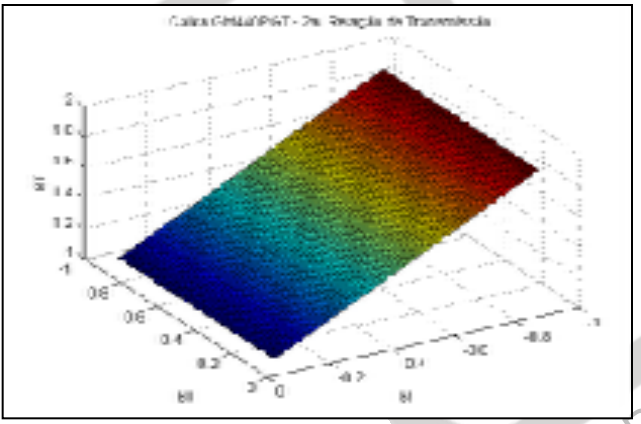
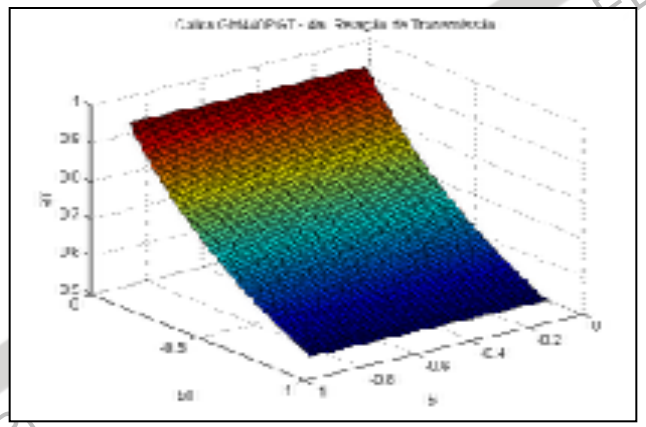
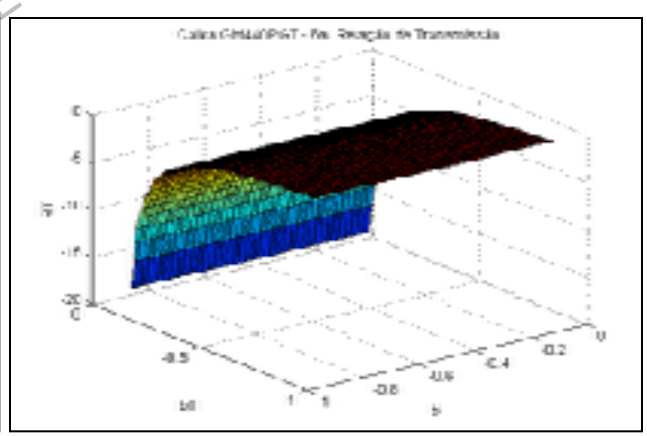
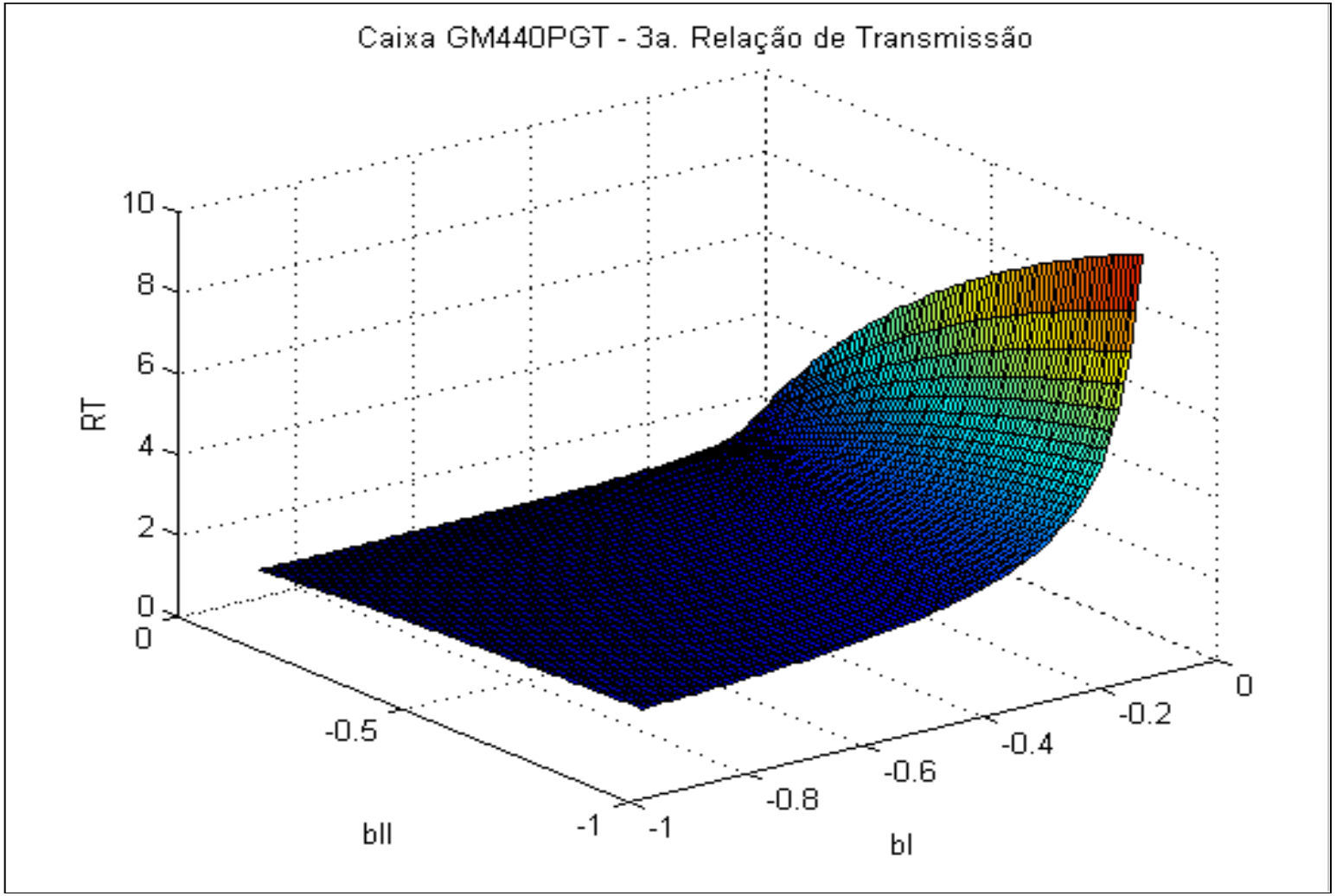
Caixa GM HIDRA-MATIC THM – 440 PGT

Gráficos 3D: b_I x b_{II} x *RT*

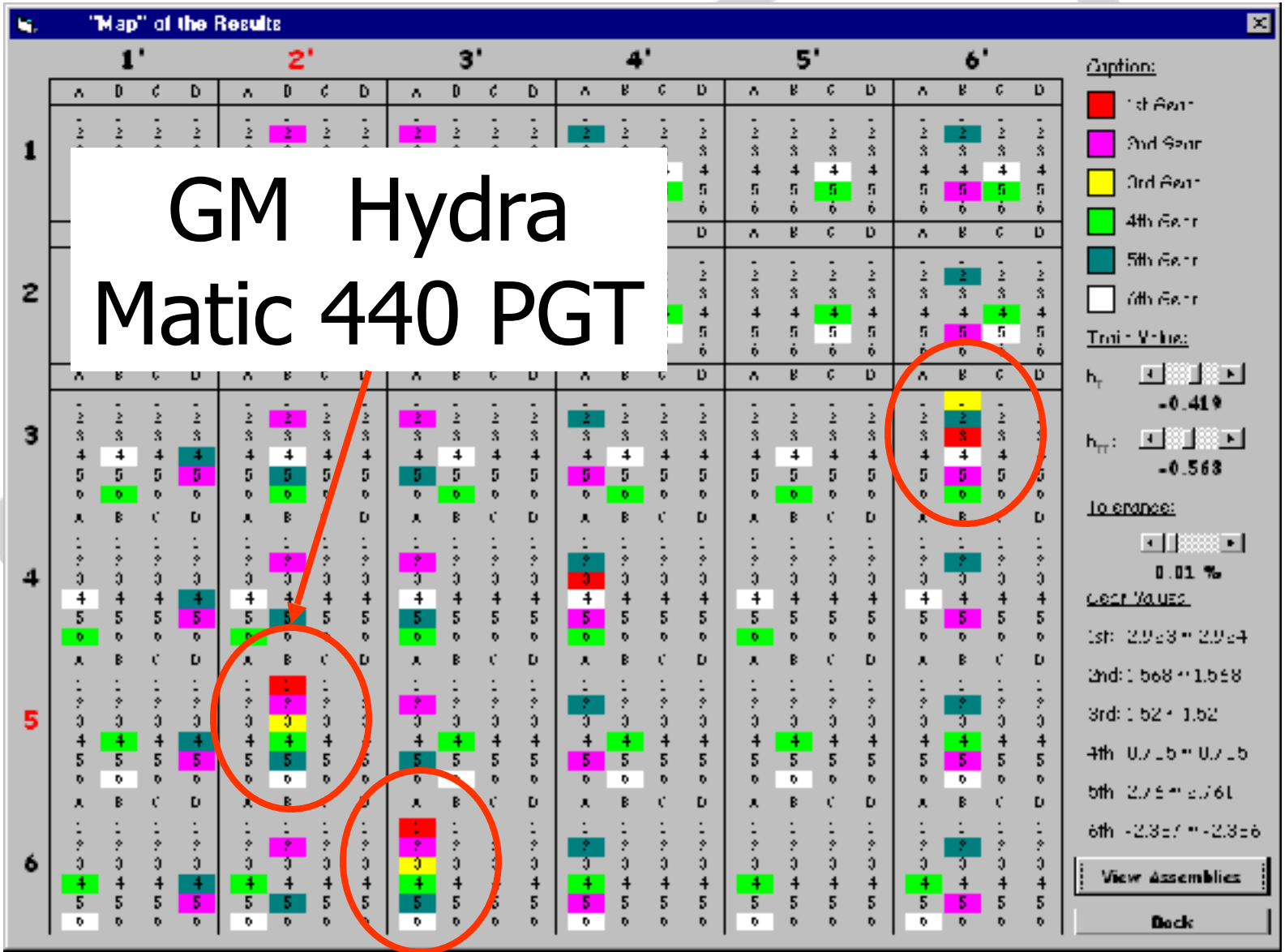
Exemplo 2 TEPs: Análise

Software TEPiciclo – Transmissão



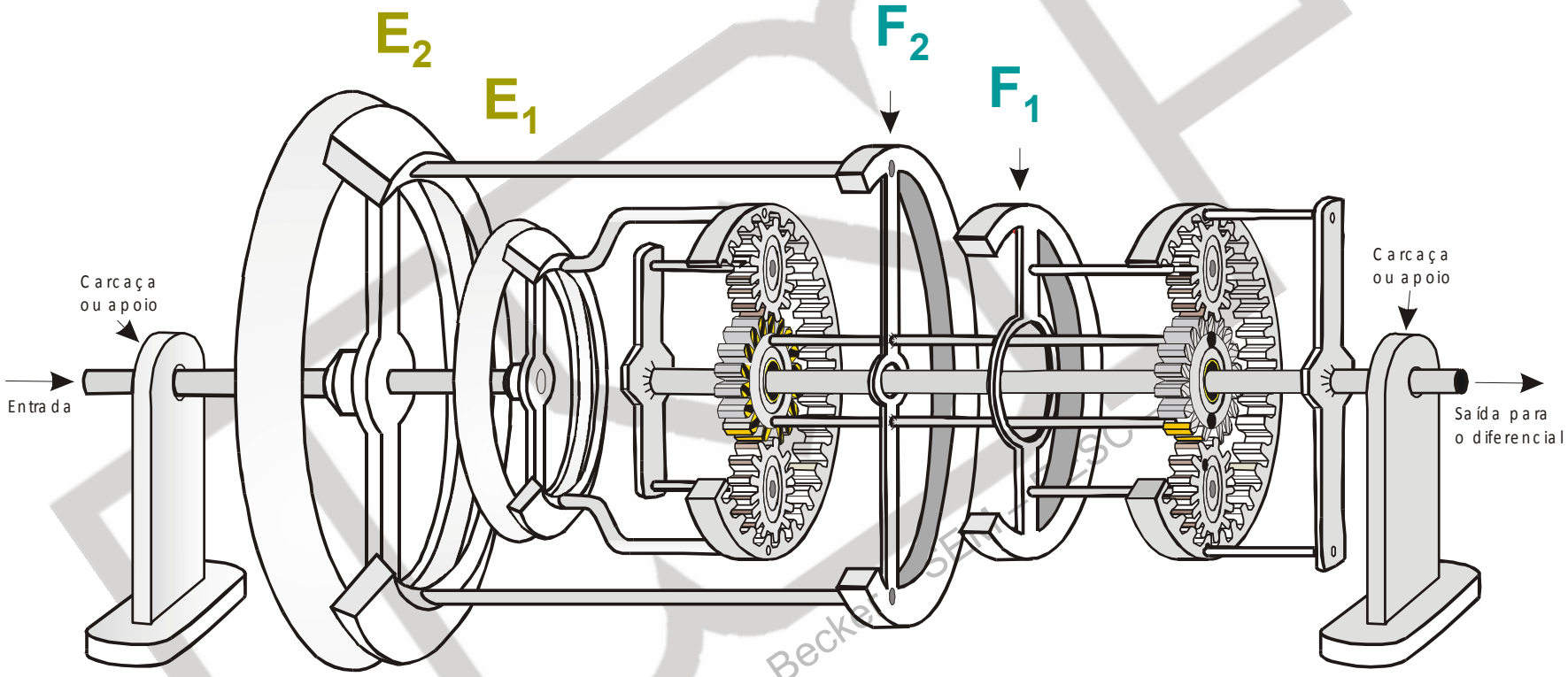
Exemplo 2 TEPs: Análise

Software TEPiciclo – Número de Dentes



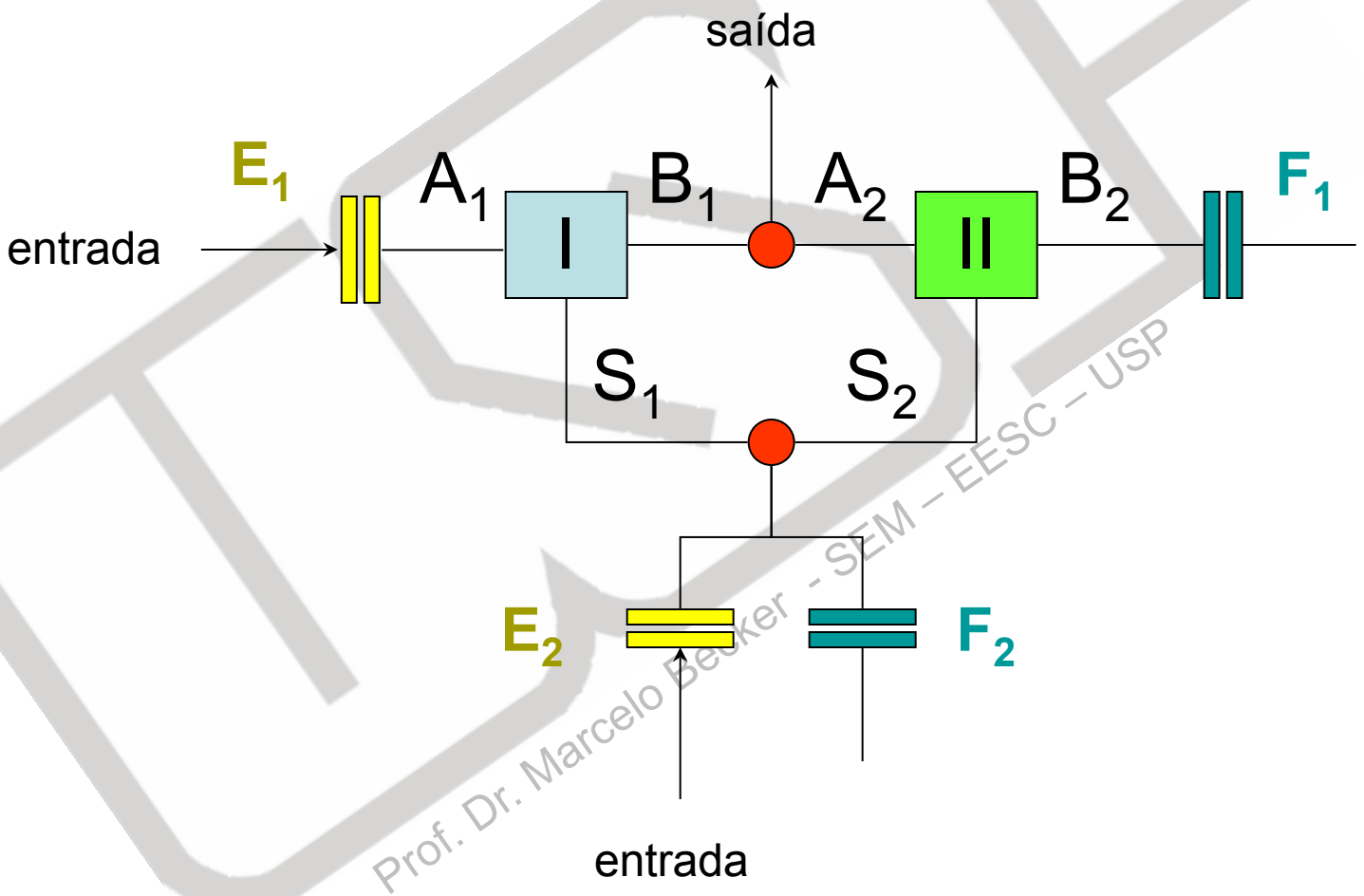
Transmissões Veiculares

Caixa Simpson



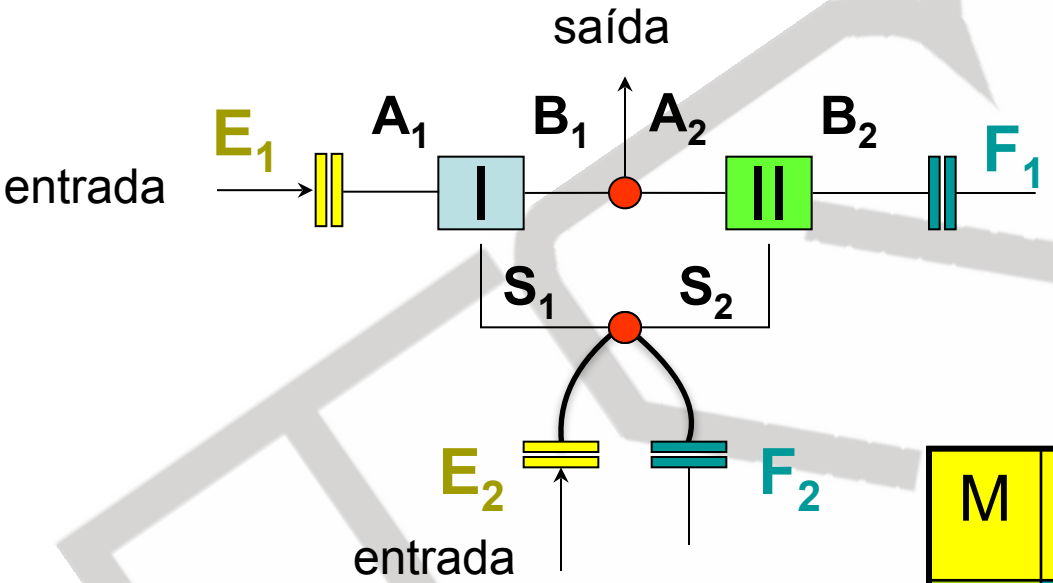
Transmissões Veiculares

Caixa Simpson



Transmissões Veiculares

Caixa Simpson

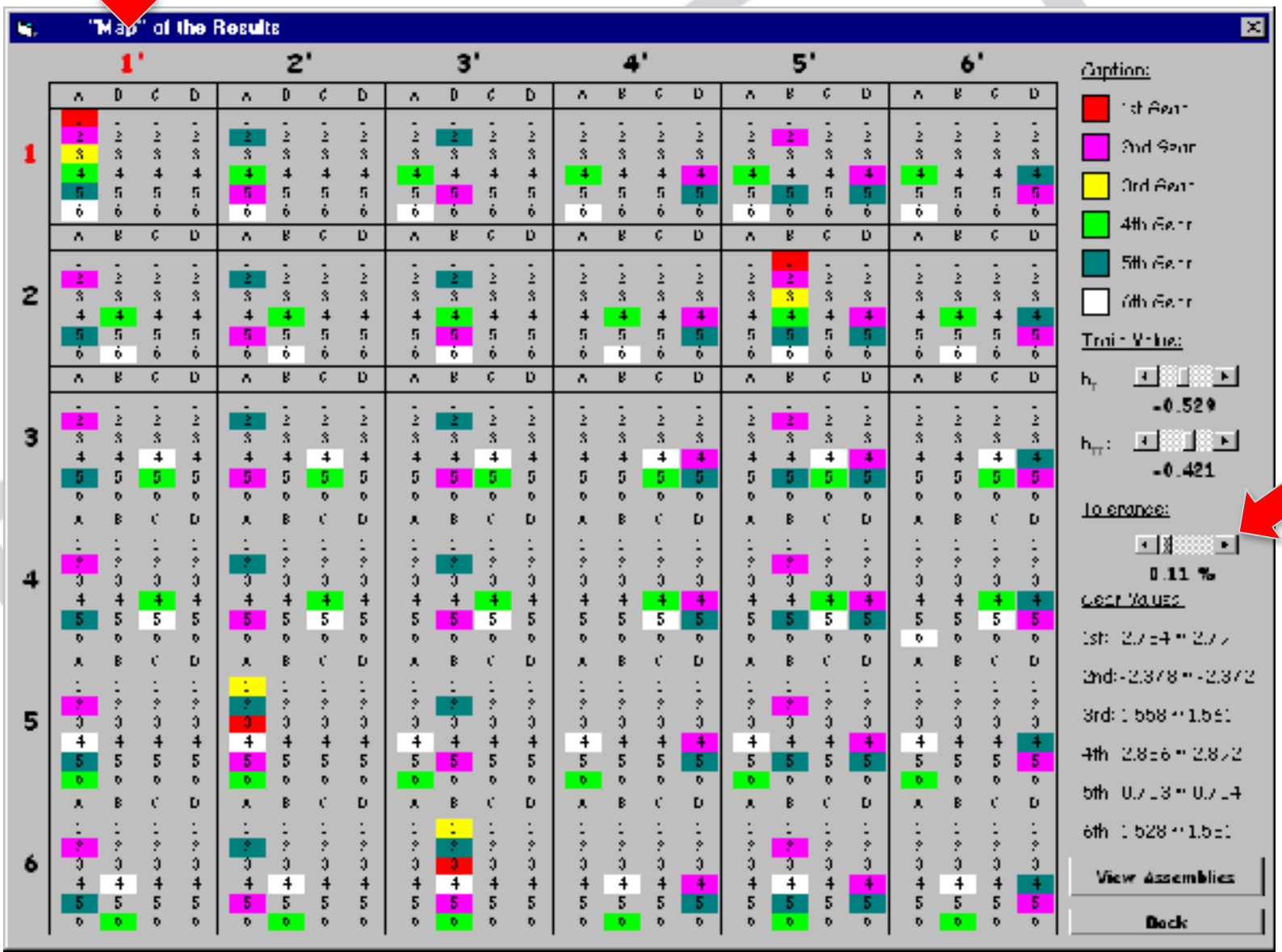


	Z_S	Z_P	Z_A
TEP I	36	16	68
TEP II	32	22	76

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

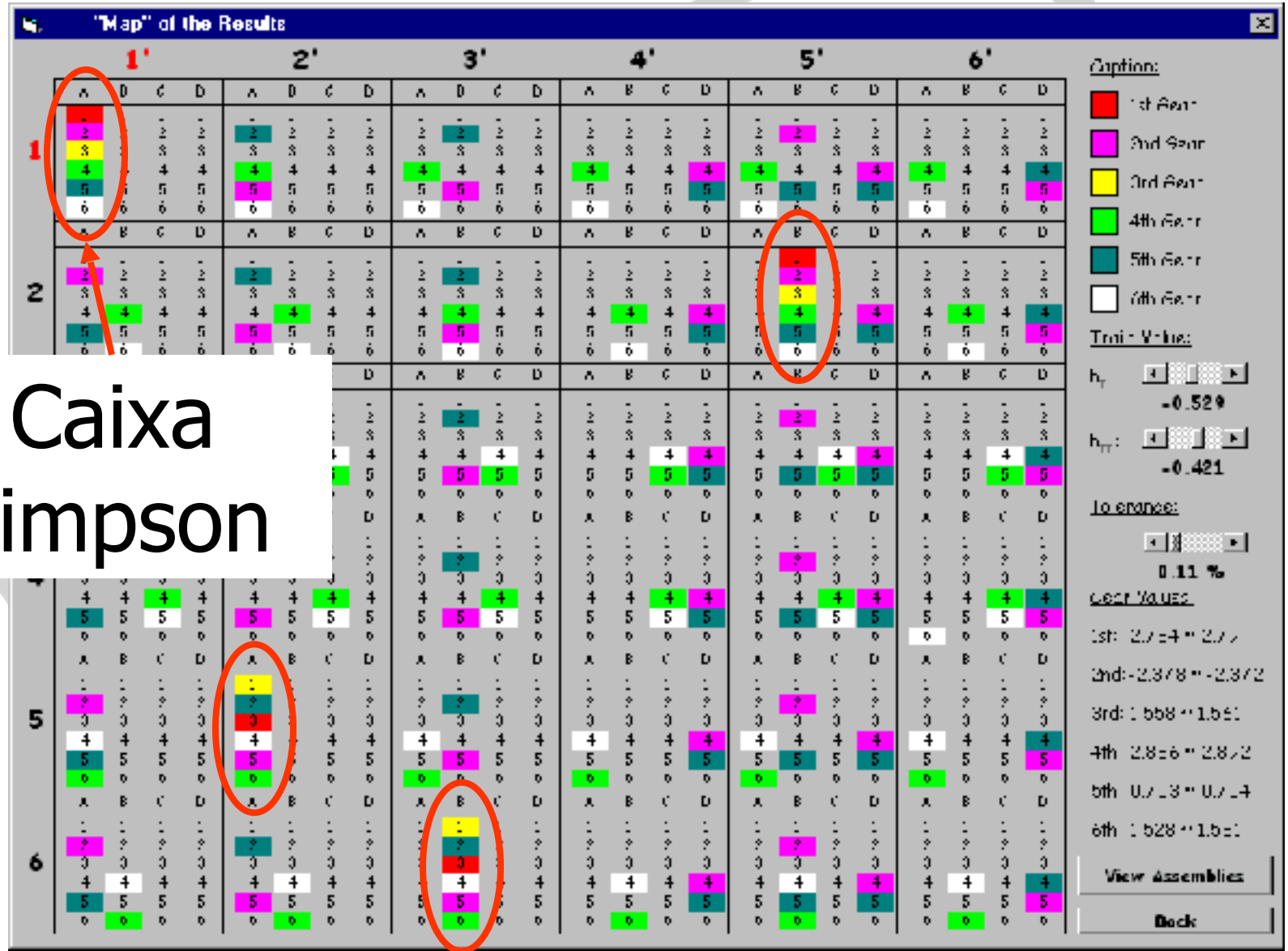
Exemplo 2 TEPs: Análise

Software TEPiciclo – Número de Dentes



Exemplo 2 TEPs: Análise

Software TEPiciclo – Número de Dentes



Sumário da Aula

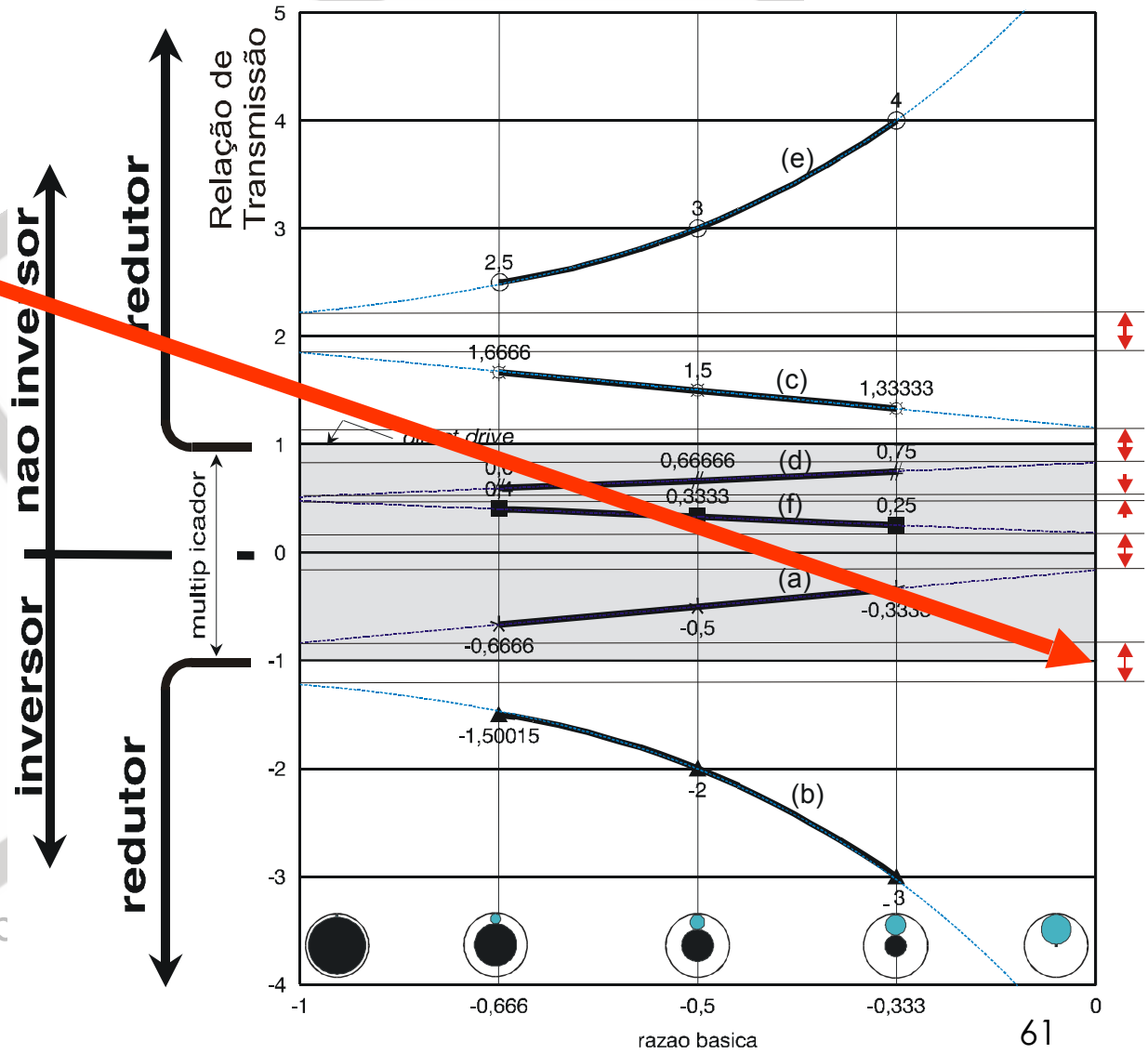
- Software TEPiciclo
- Exemplo 1 TEP: Análise
- Exemplo 1 TEP: Síntese
- Exemplo 2 TEPs: Análise
- **Exemplo 2 TEPs: Síntese**

Exemplo 2 TEPs: Síntese

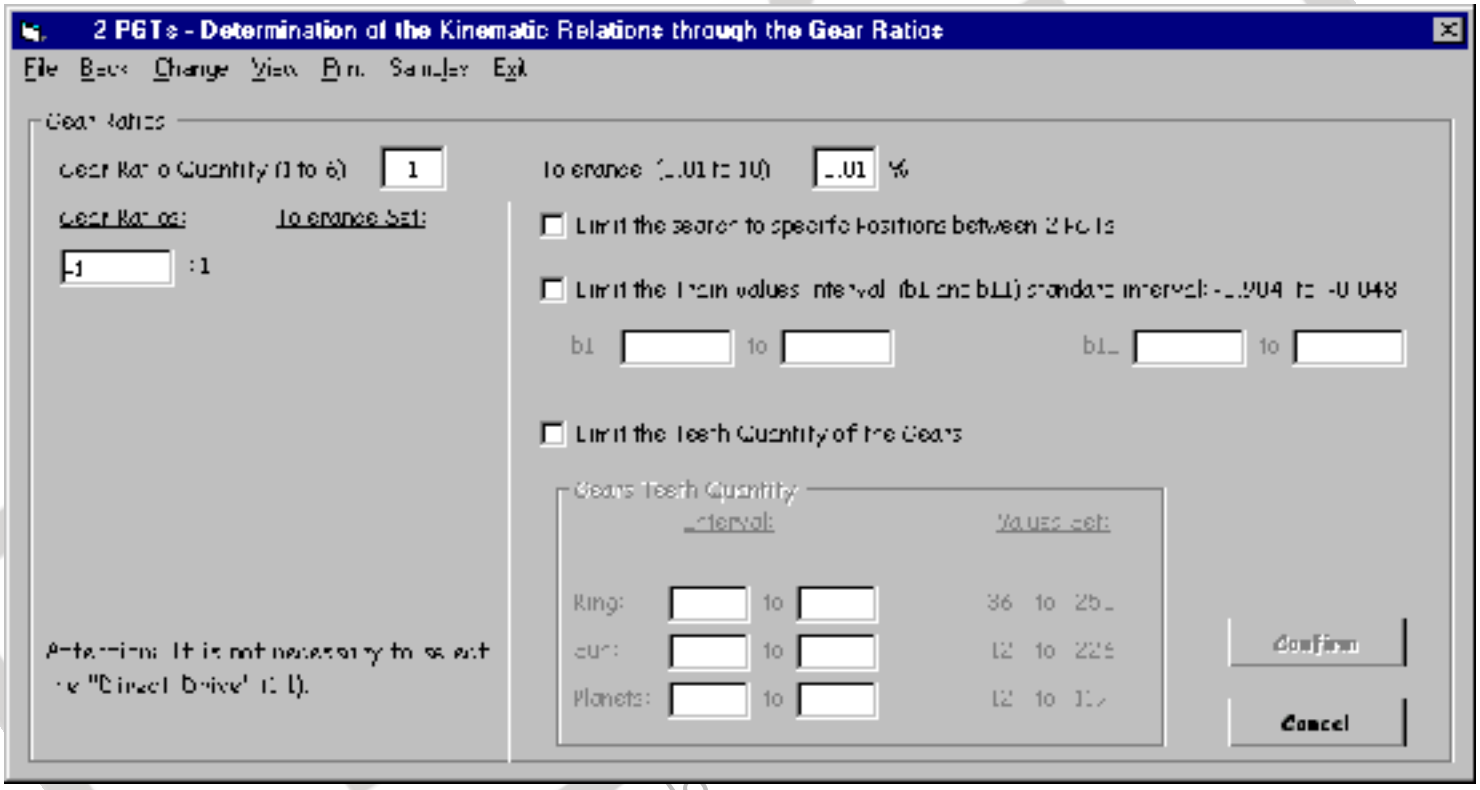
Software TEPiciclo – Transmissão

[-1.105;-0.905]

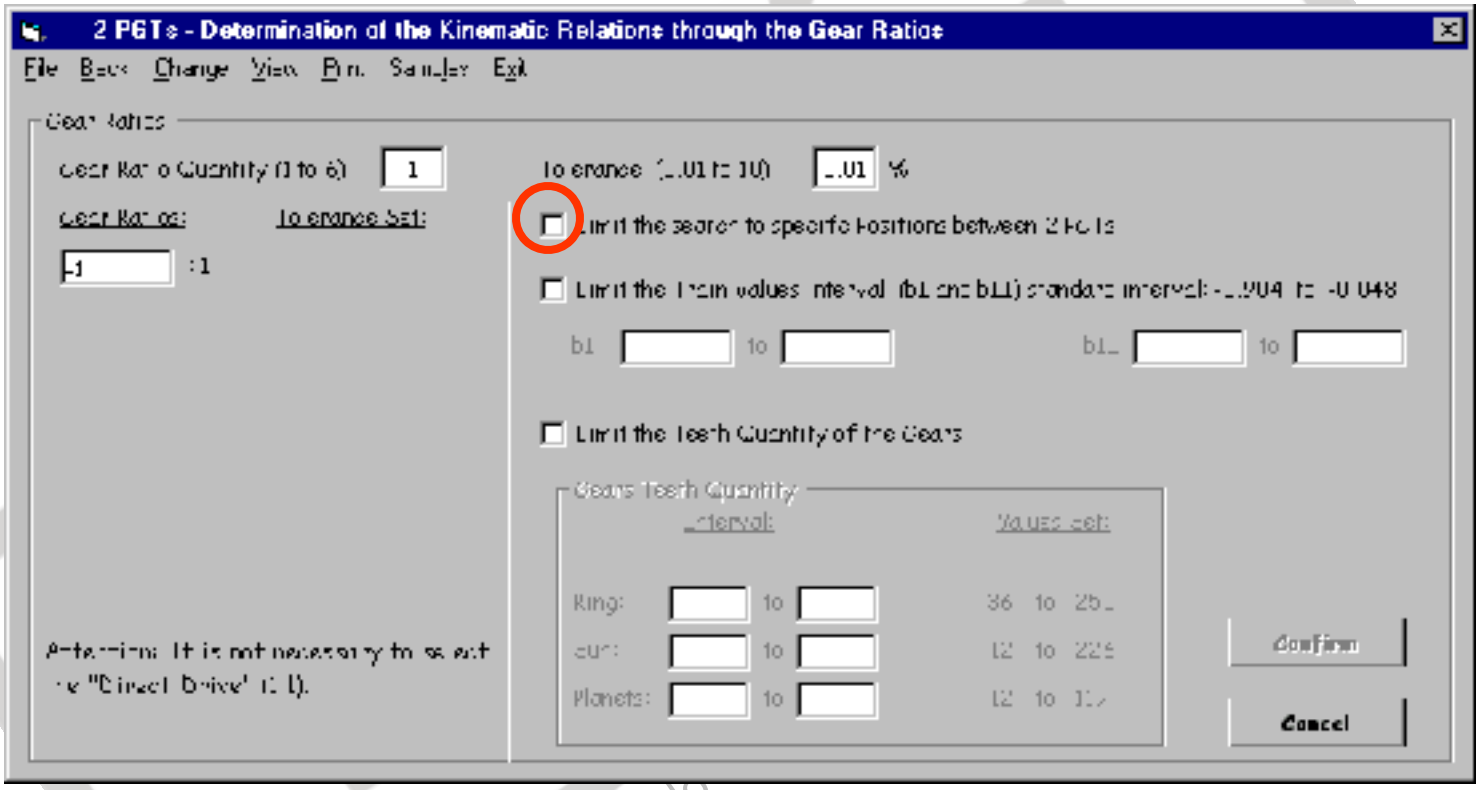
RT= -1 : 1



Exemplo 2 TEPs: Síntese
Software TEPiciclo – Transmissão

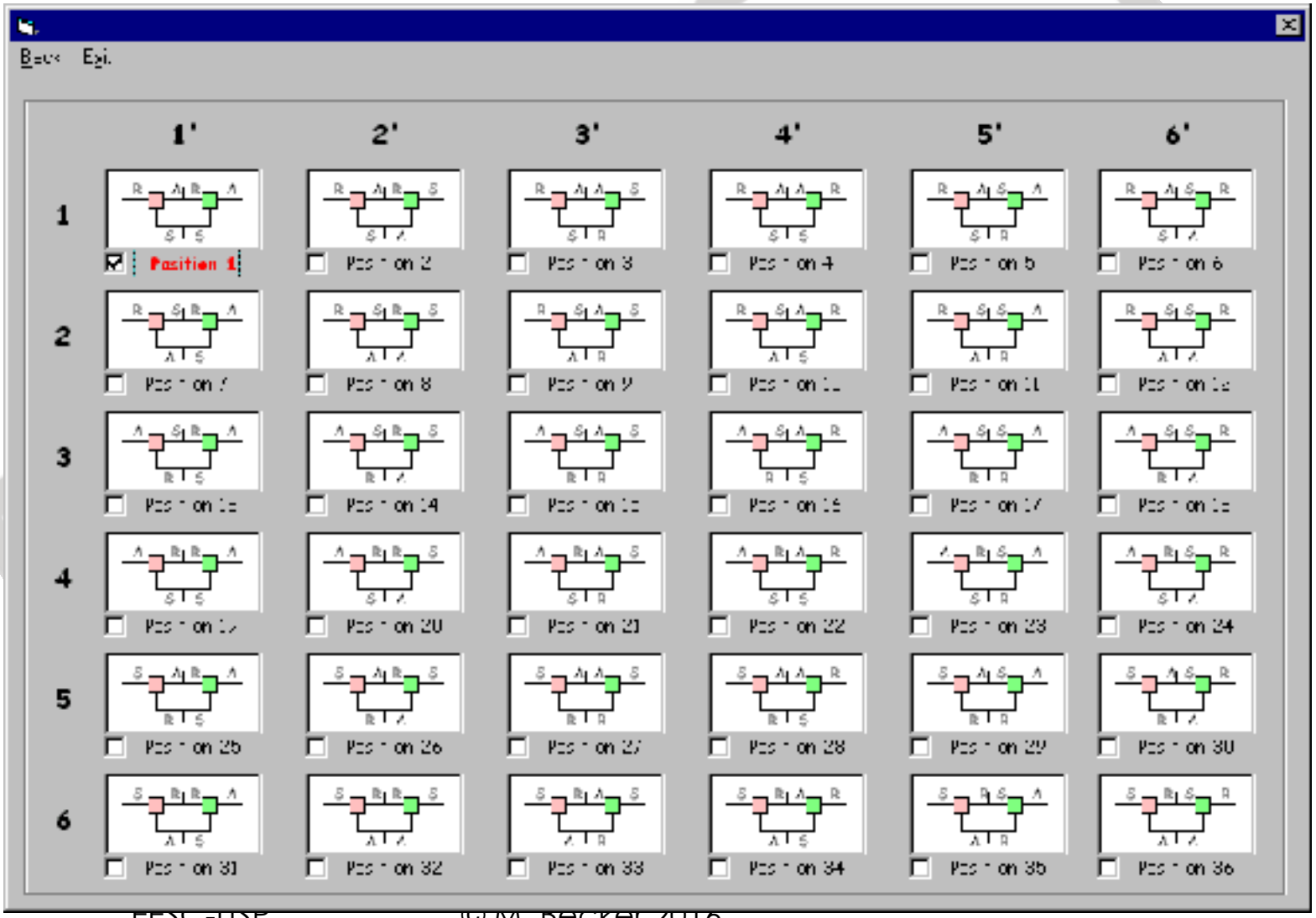


Exemplo 2 TEPs: Síntese
Software TEPiciclo – Transmissão



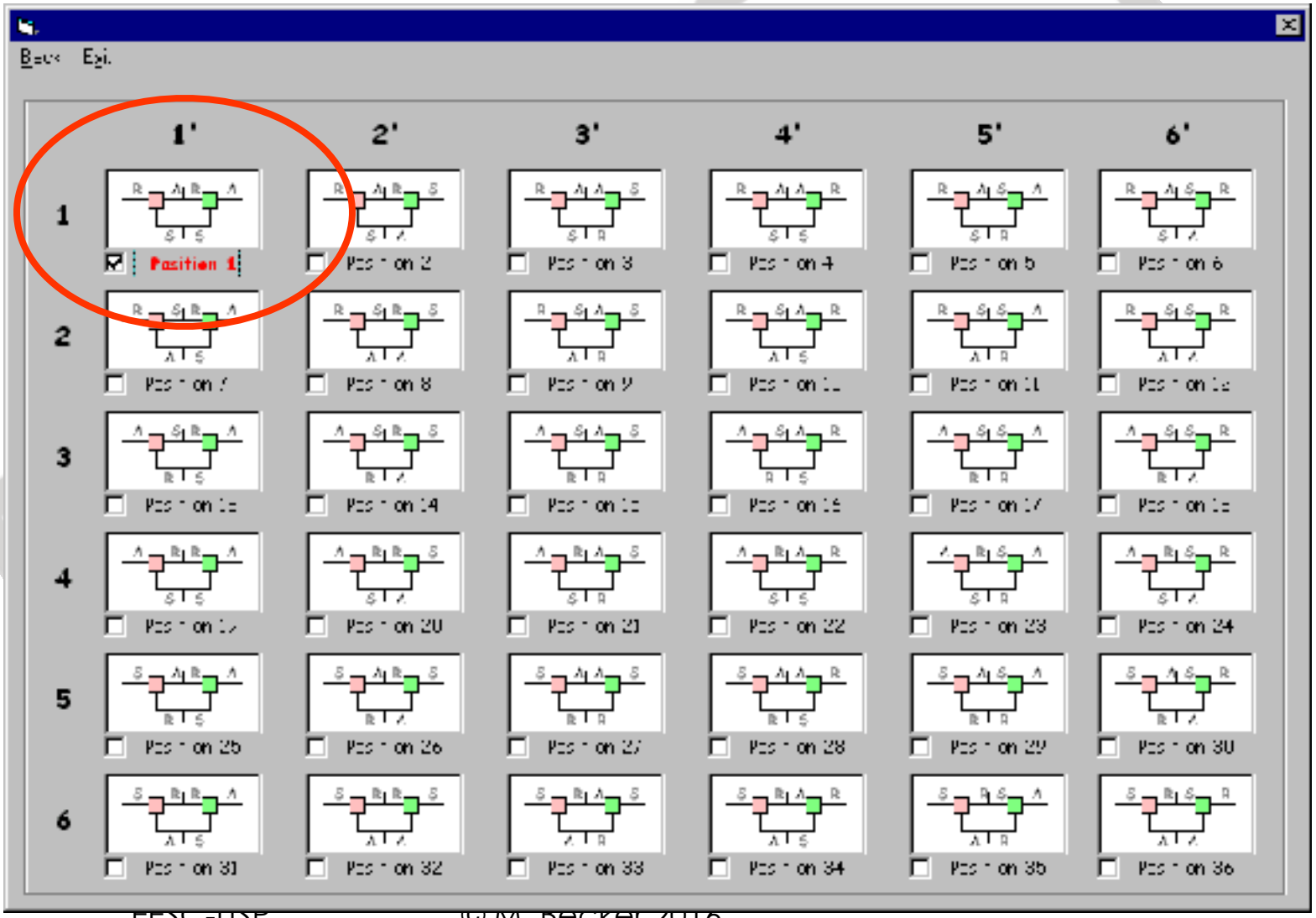
Exemplo 2 TEPs: Síntese

Software TEPiciclo – Transmissão



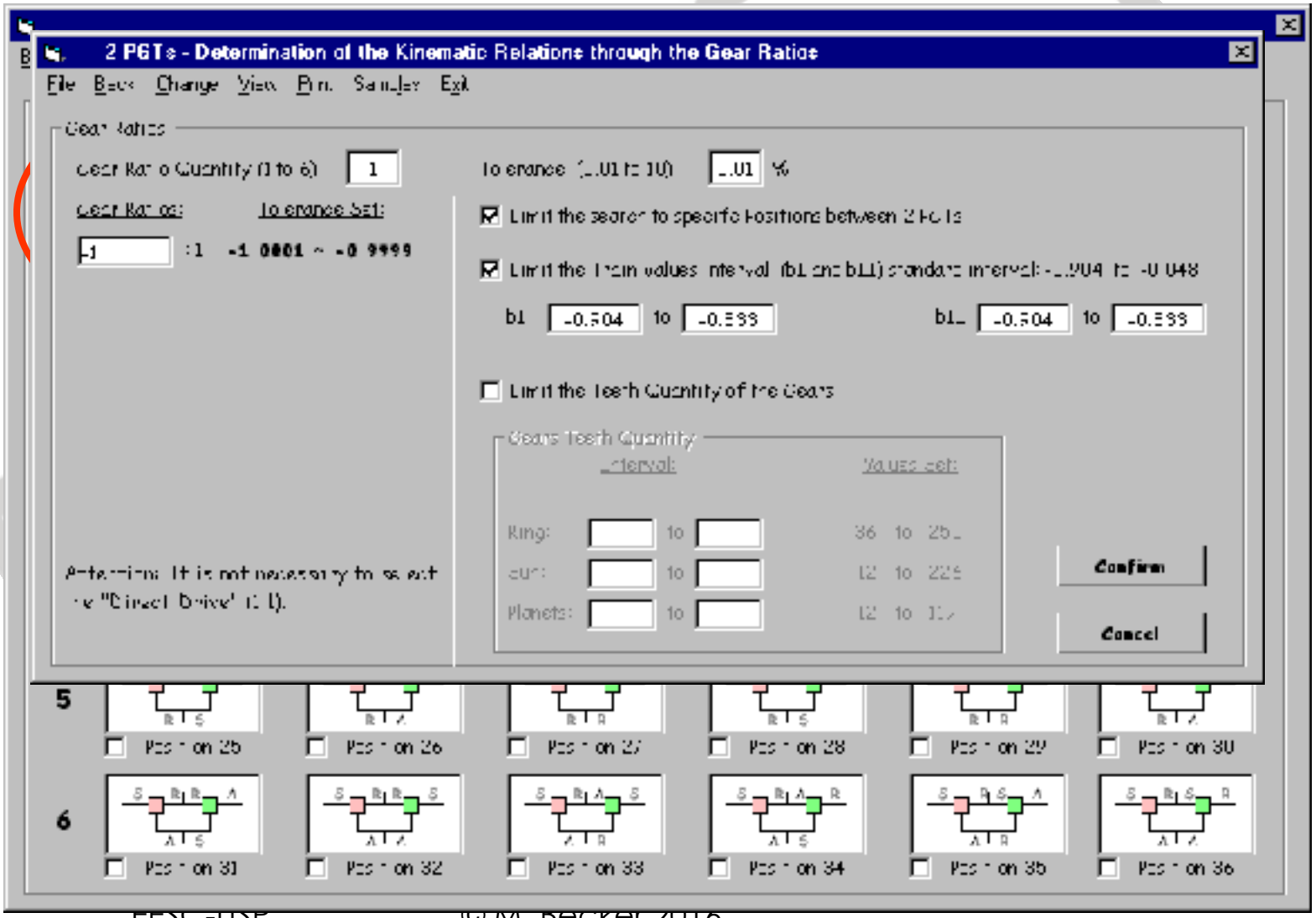
Exemplo 2 TEPs: Síntese

Software TEPiciclo – Transmissão



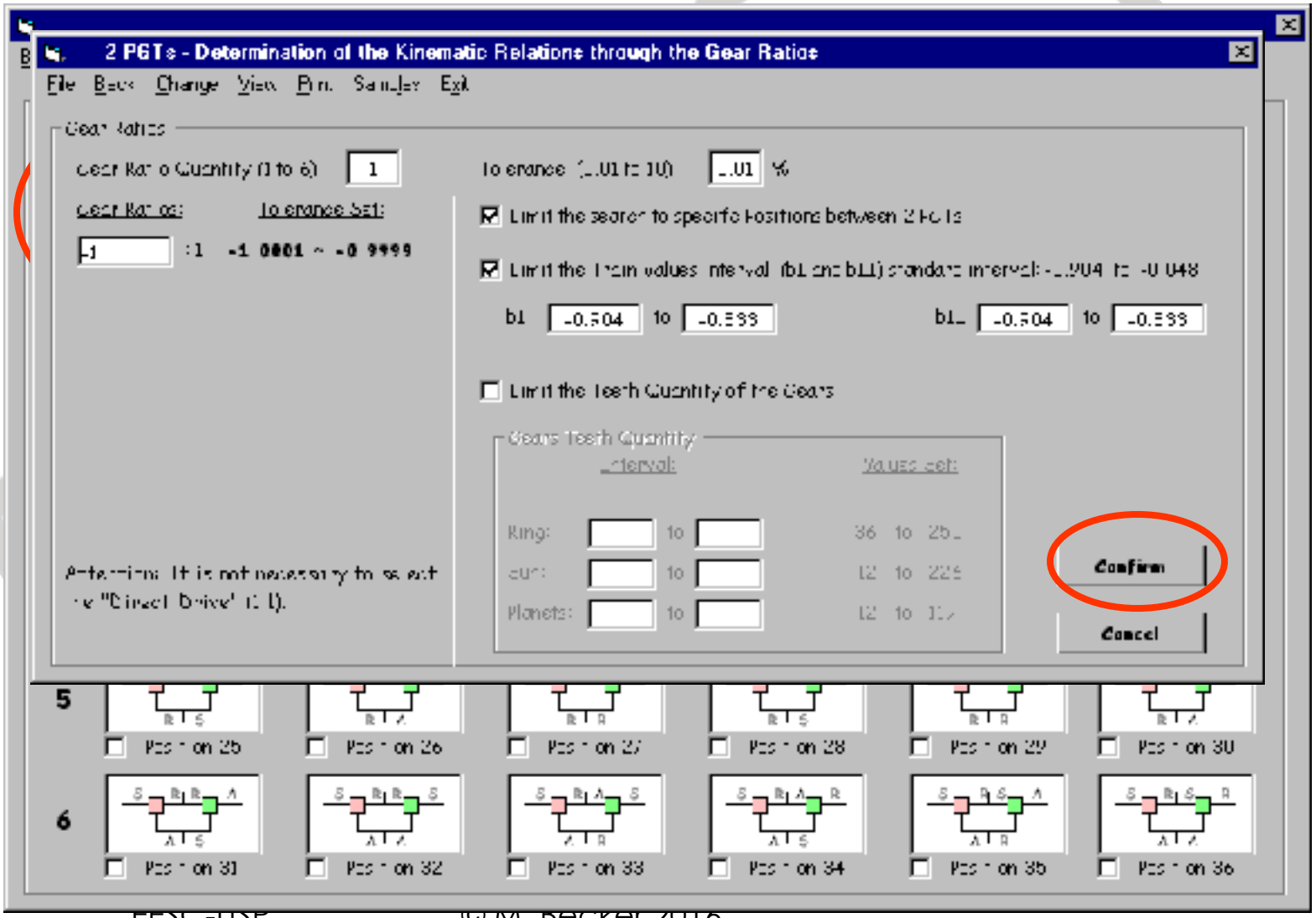
Exemplo 2 TEPs: Síntese

Software TEPiciclo – Transmissão



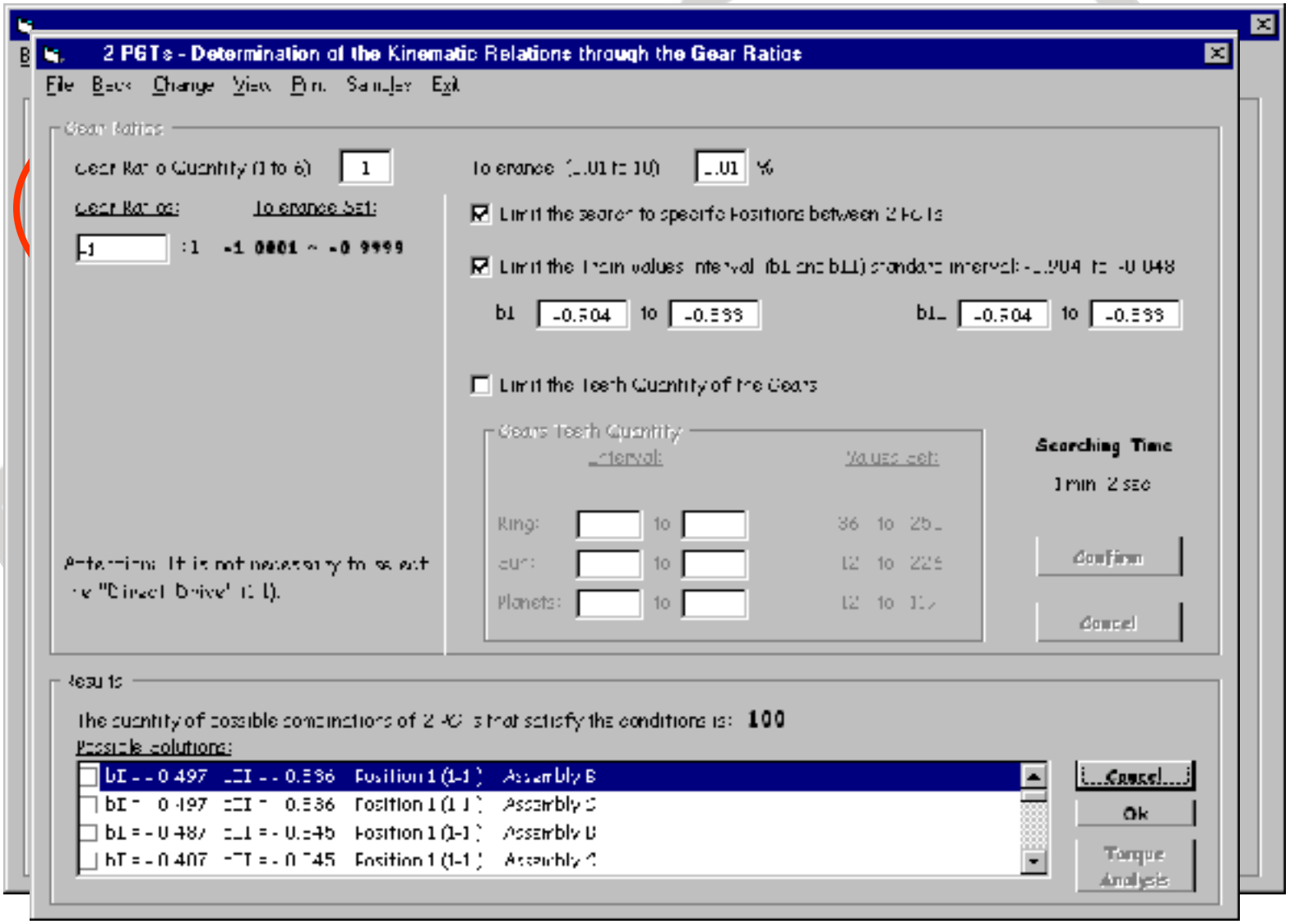
Exemplo 2 TEPs: Síntese

Software TEPiciclo – Transmissão



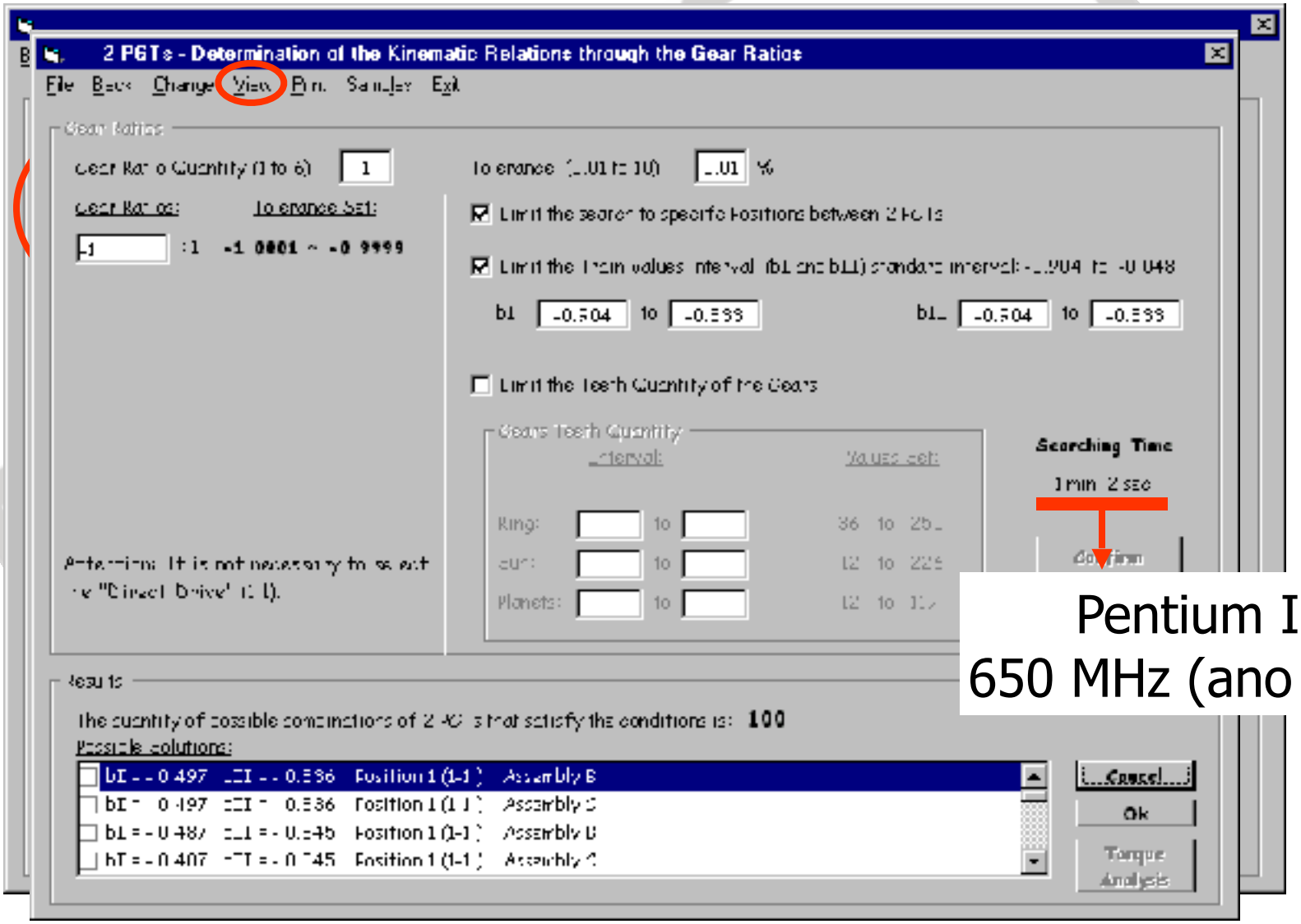
Exemplo 2 TEPs: Síntese

Software TEPiciclo – Transmissão



Exemplo 2 TEPs: Síntese

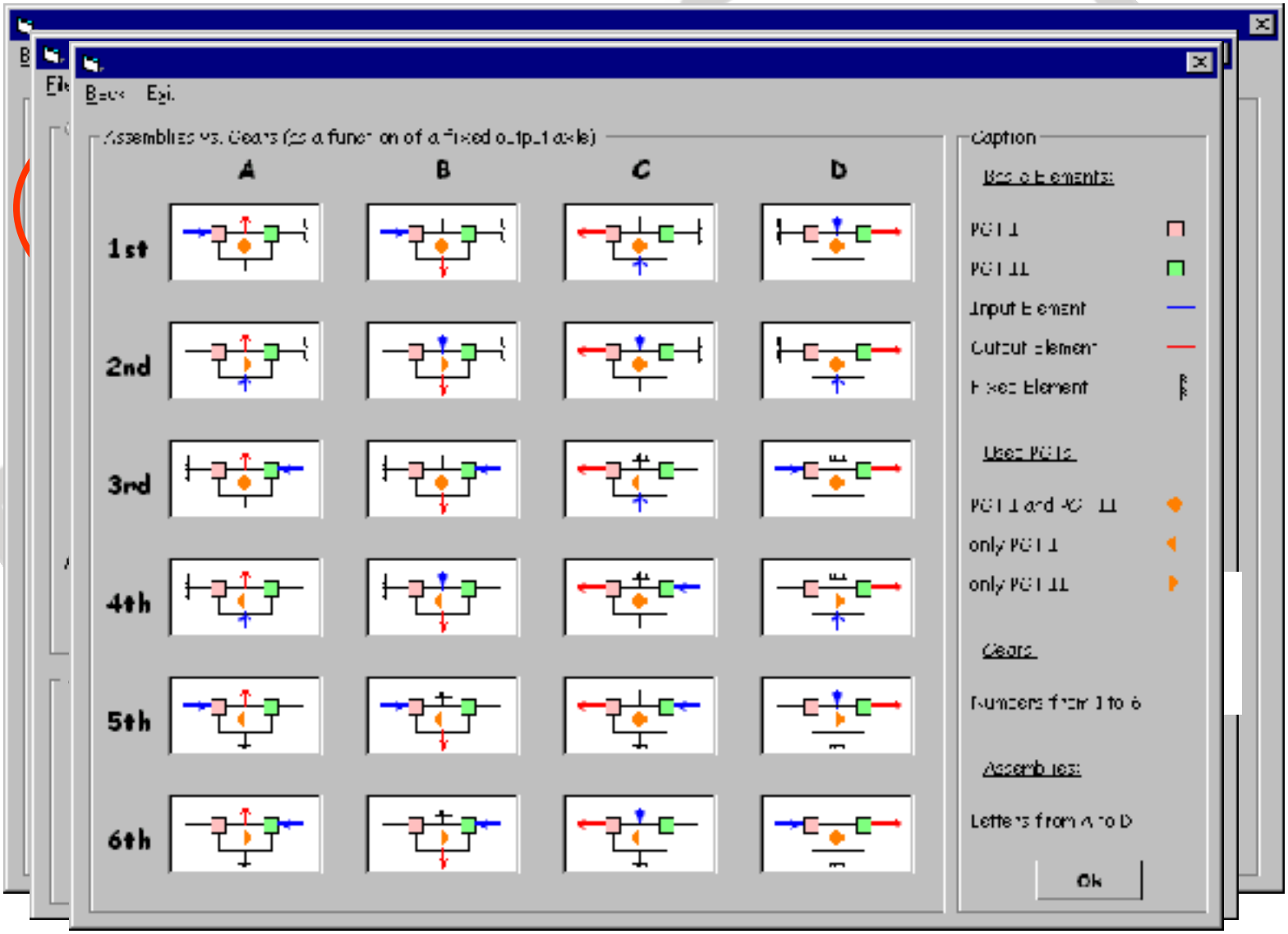
Software TEPiciclo – Transmissão



Pentium III
650 MHz (ano 2000)

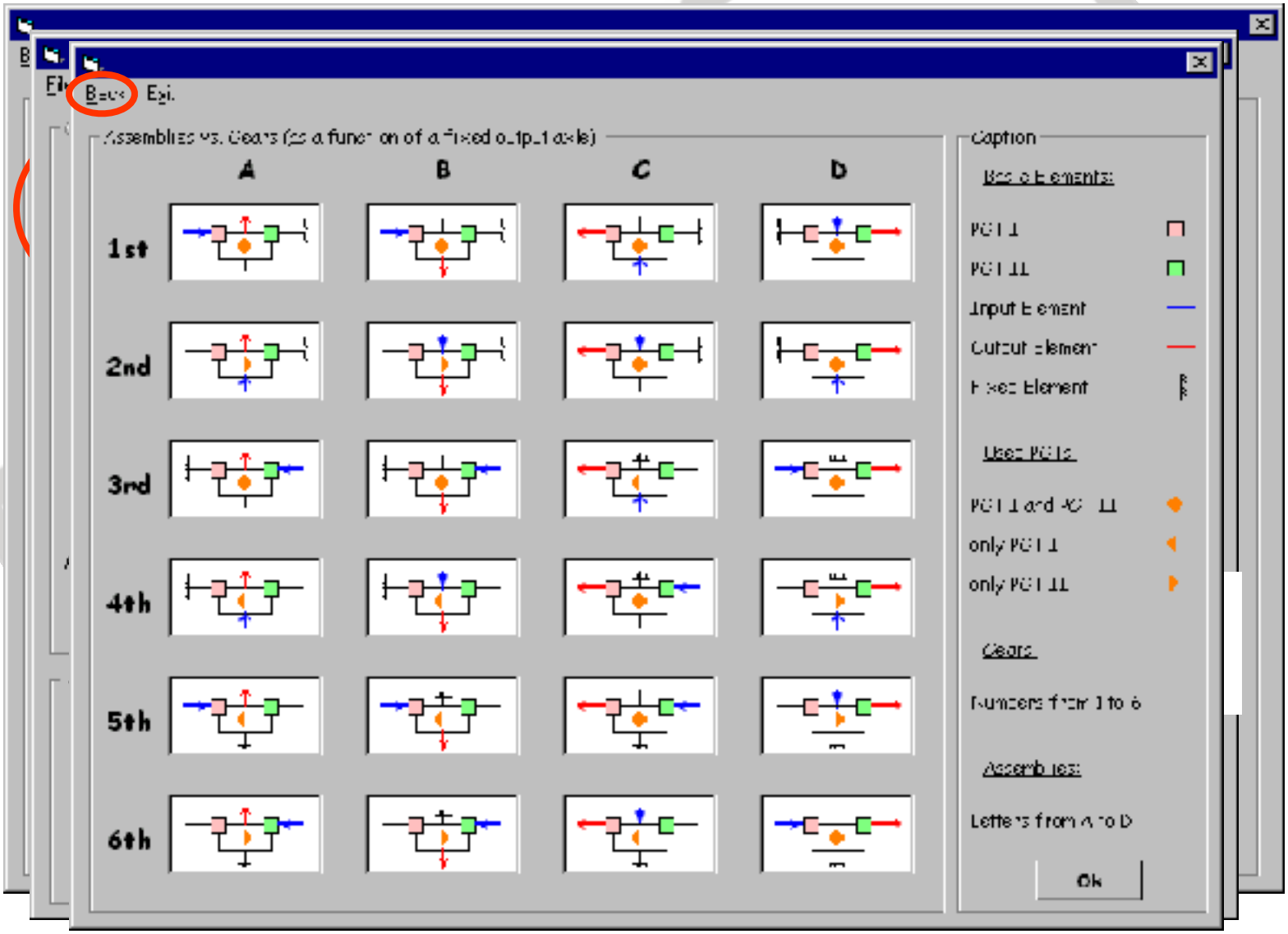
Exemplo 2 TEPs: Síntese

Software TEPiciclo – Transmissão



Exemplo 2 TEPs: Síntese

Software TEPiciclo – Transmissão



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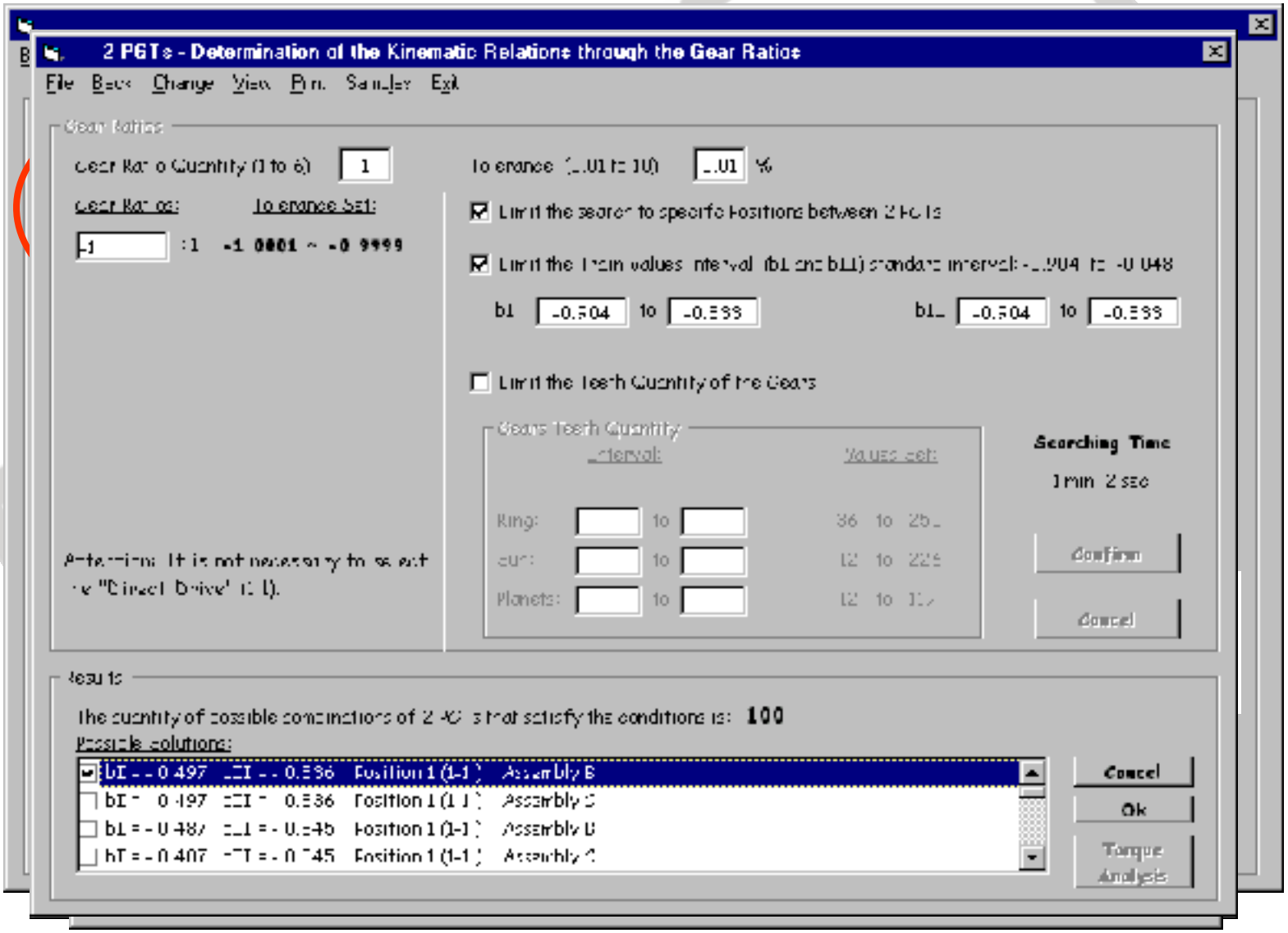

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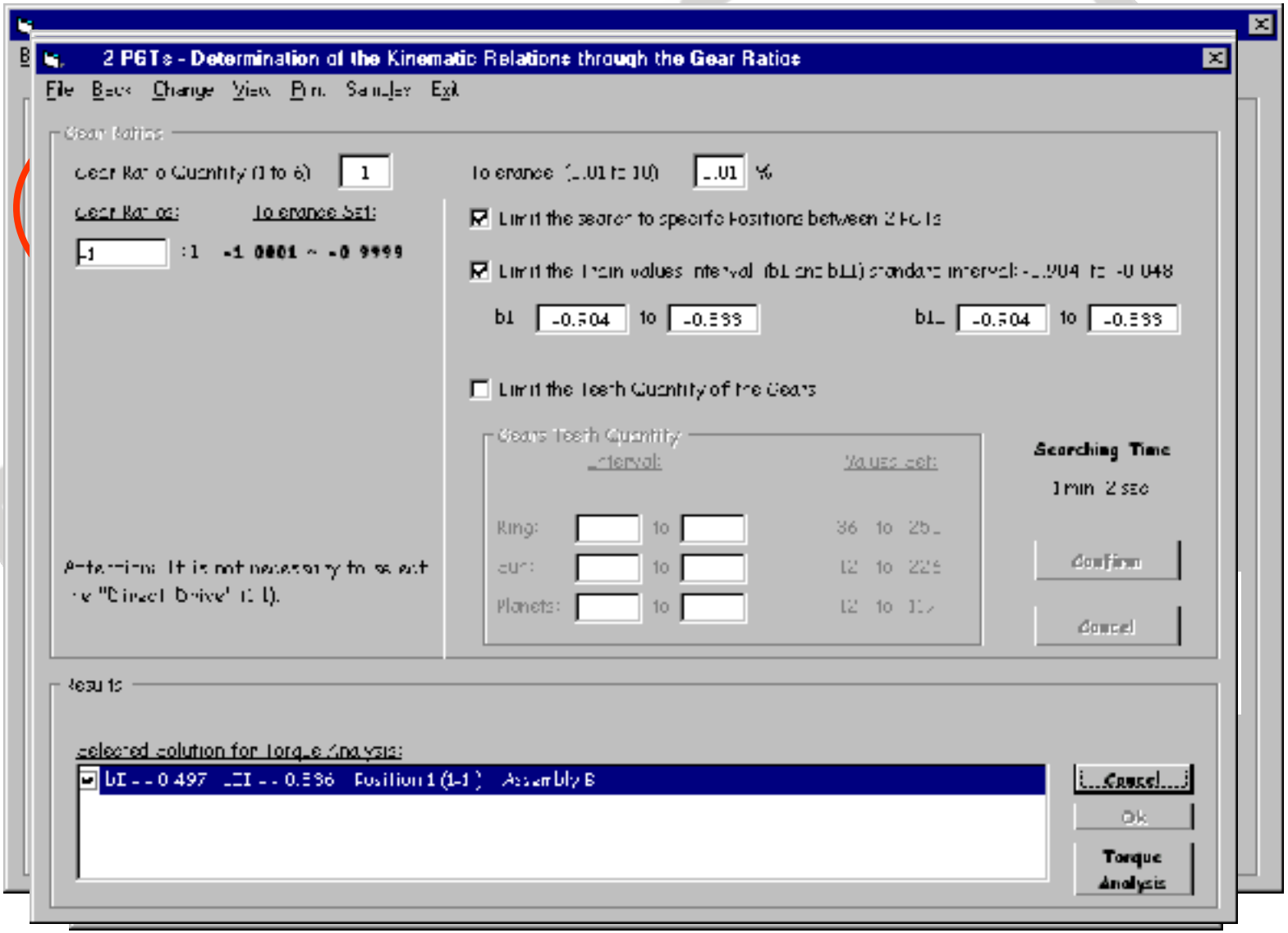


Exemplo 2 TEPs: Síntese
Software TEPiciclo – Transmissão

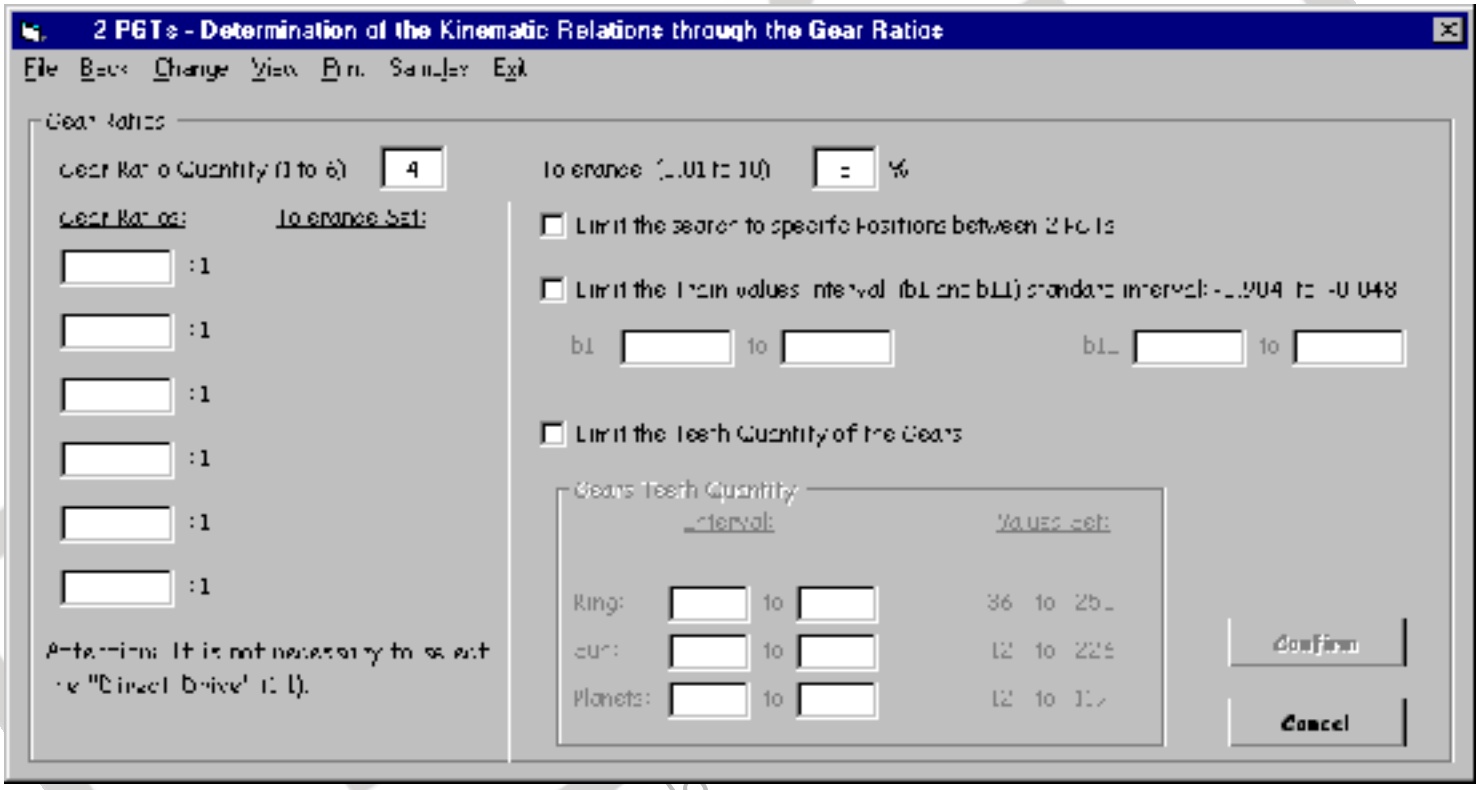
Exemplo do Projeto de uma Nova Transmissão Automática

RTs:

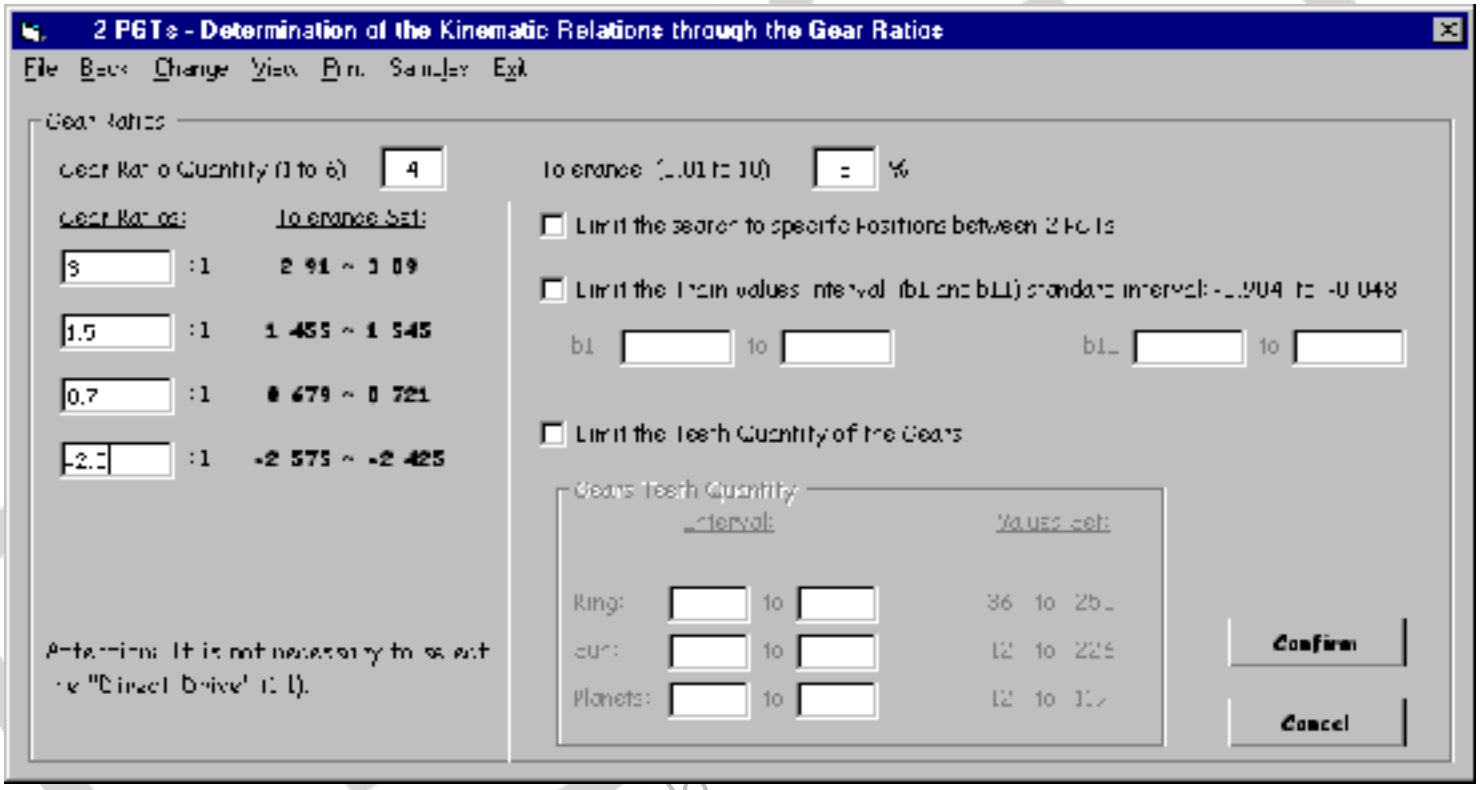
3,0	:1
1,5	:1
1,0	:1
0,7	:1
-2,5	:1

- Tolerância: ± 3%
- Razão Básica [-0,7; -0,5]
- TEP II maior que TEP I

Exemplo 2 TEPs: Síntese
Software TEPiciclo – Transmissão



Exemplo 2 TEPs: Síntese
Software TEPiciclo – Transmissão



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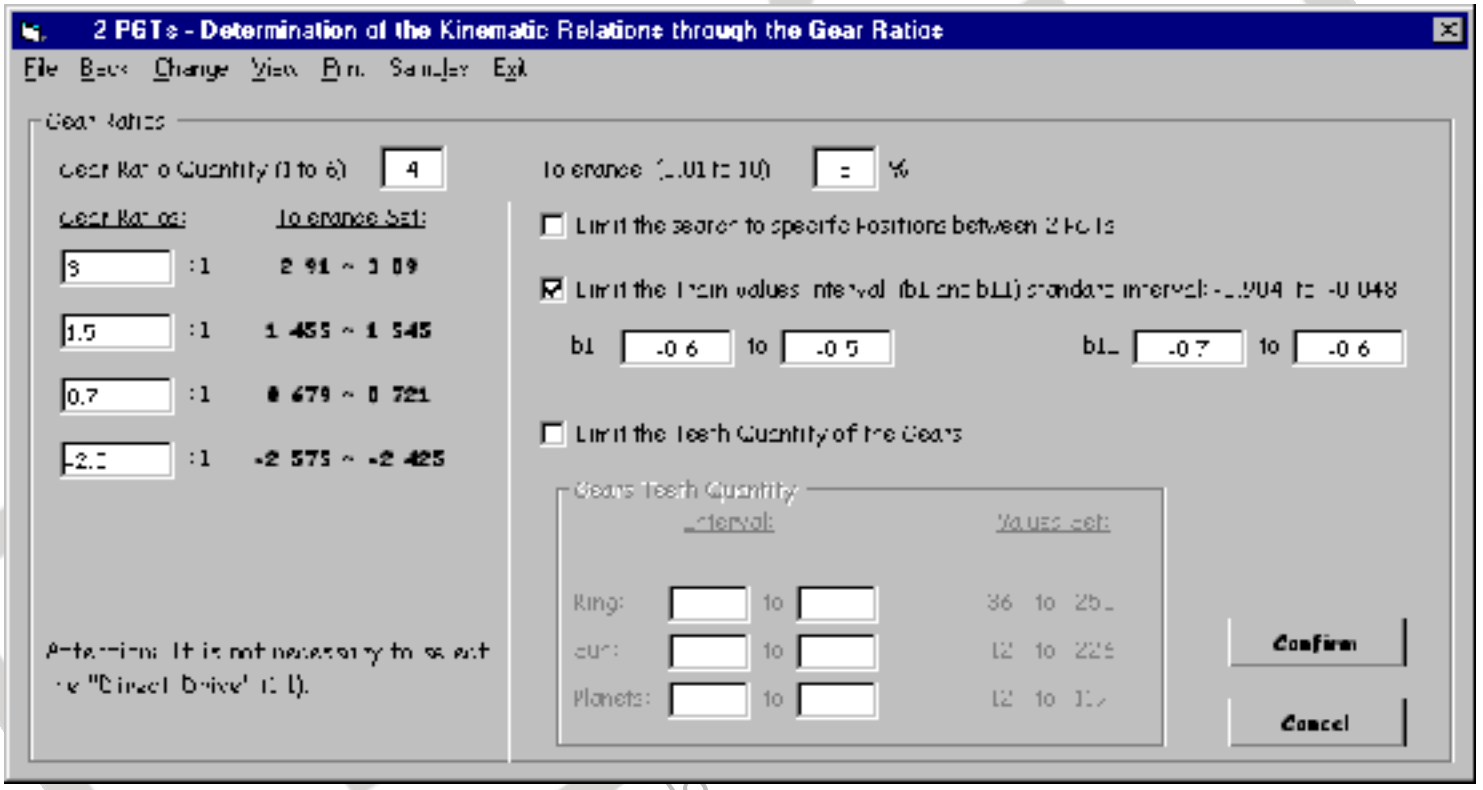
Software TEPiciclo – Transmissão



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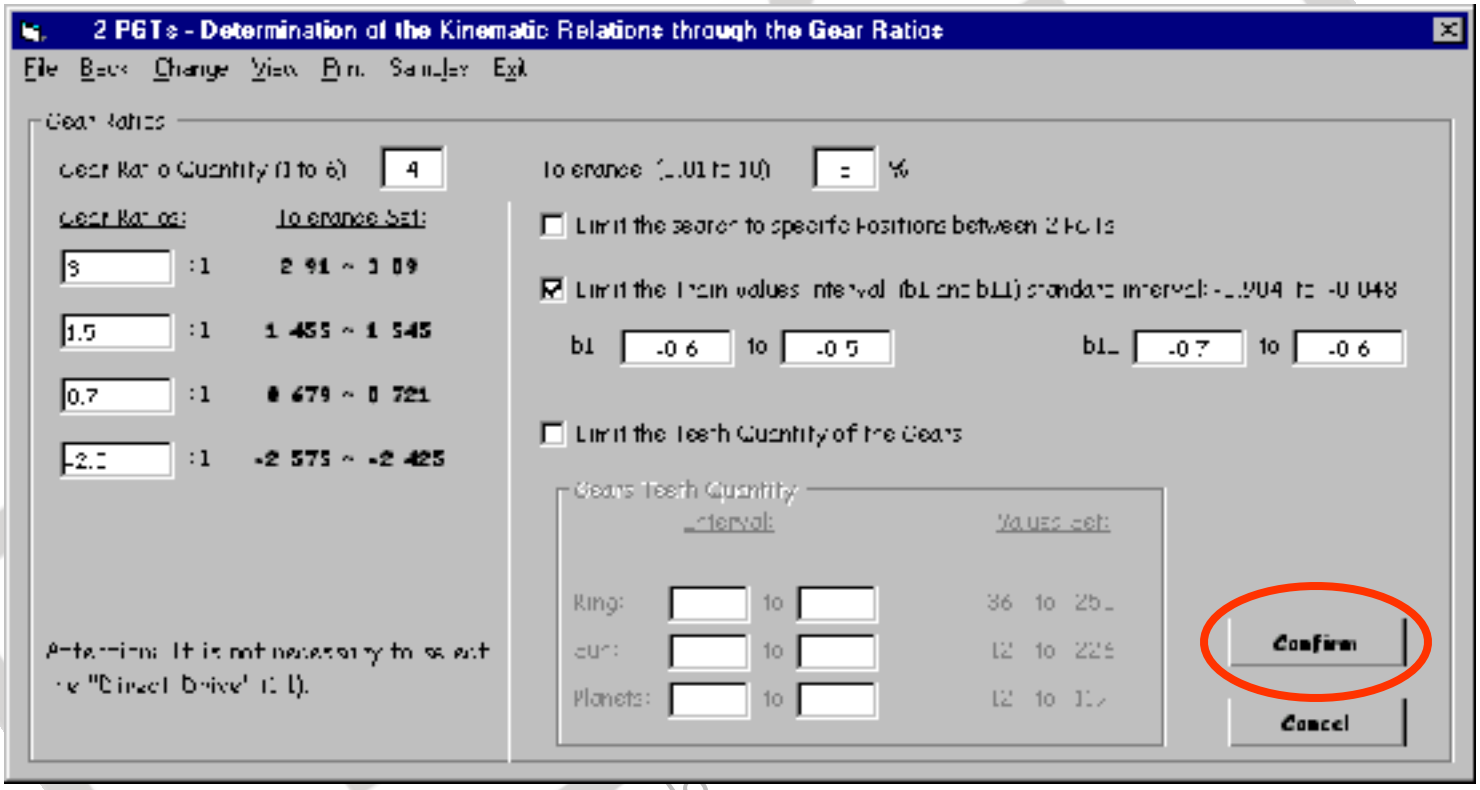
Software TEPiciclo – Transmissão



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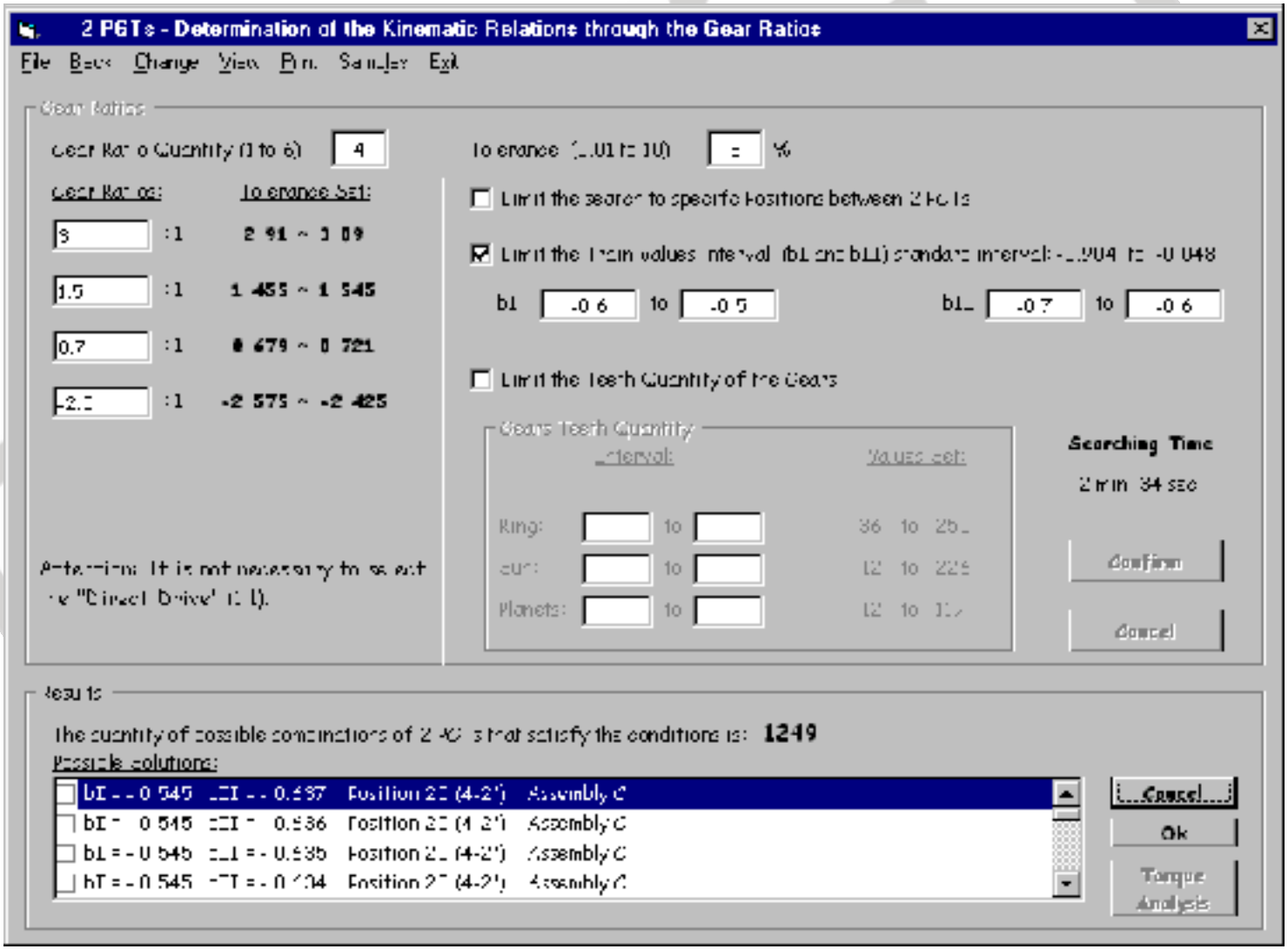

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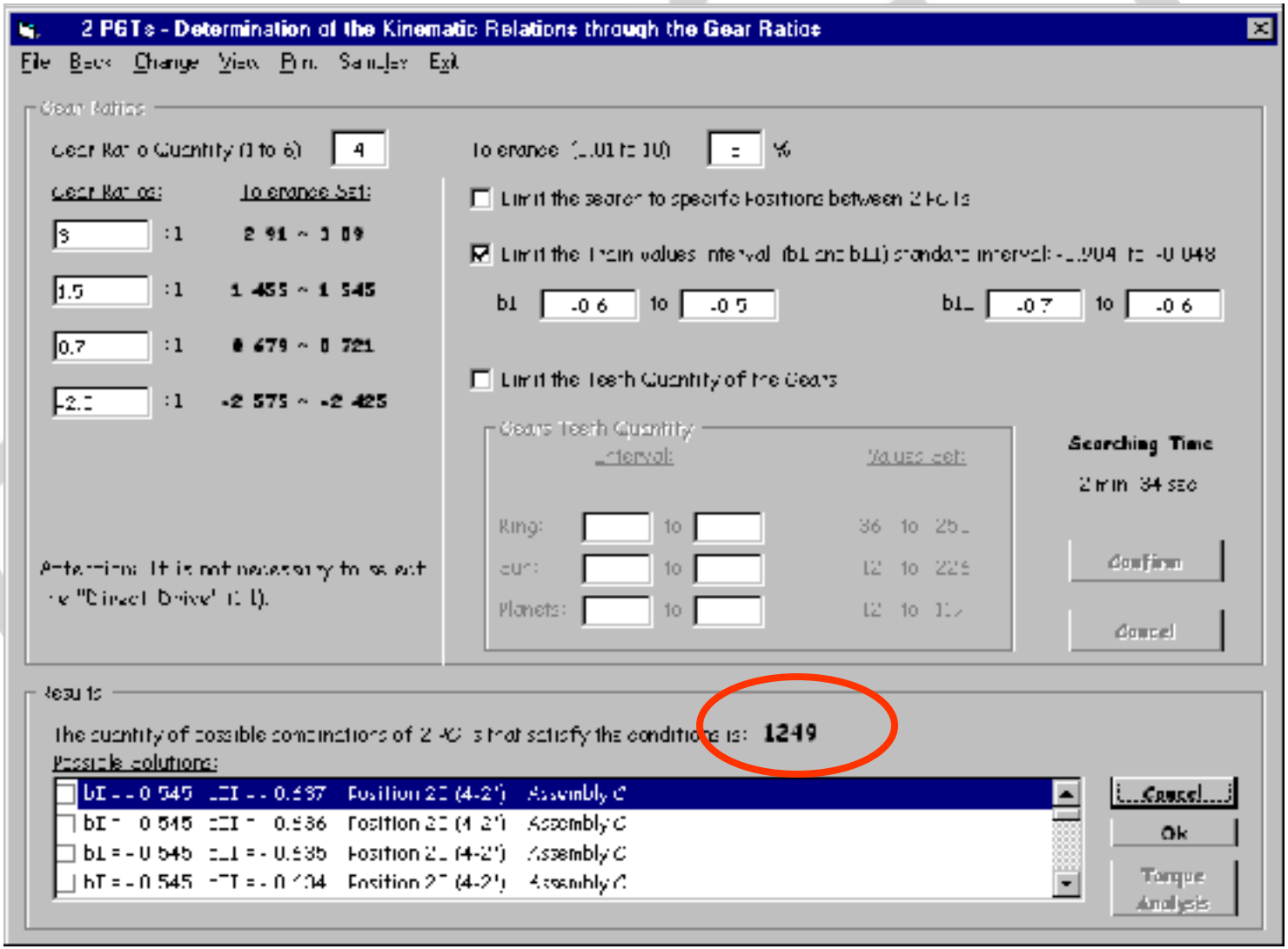

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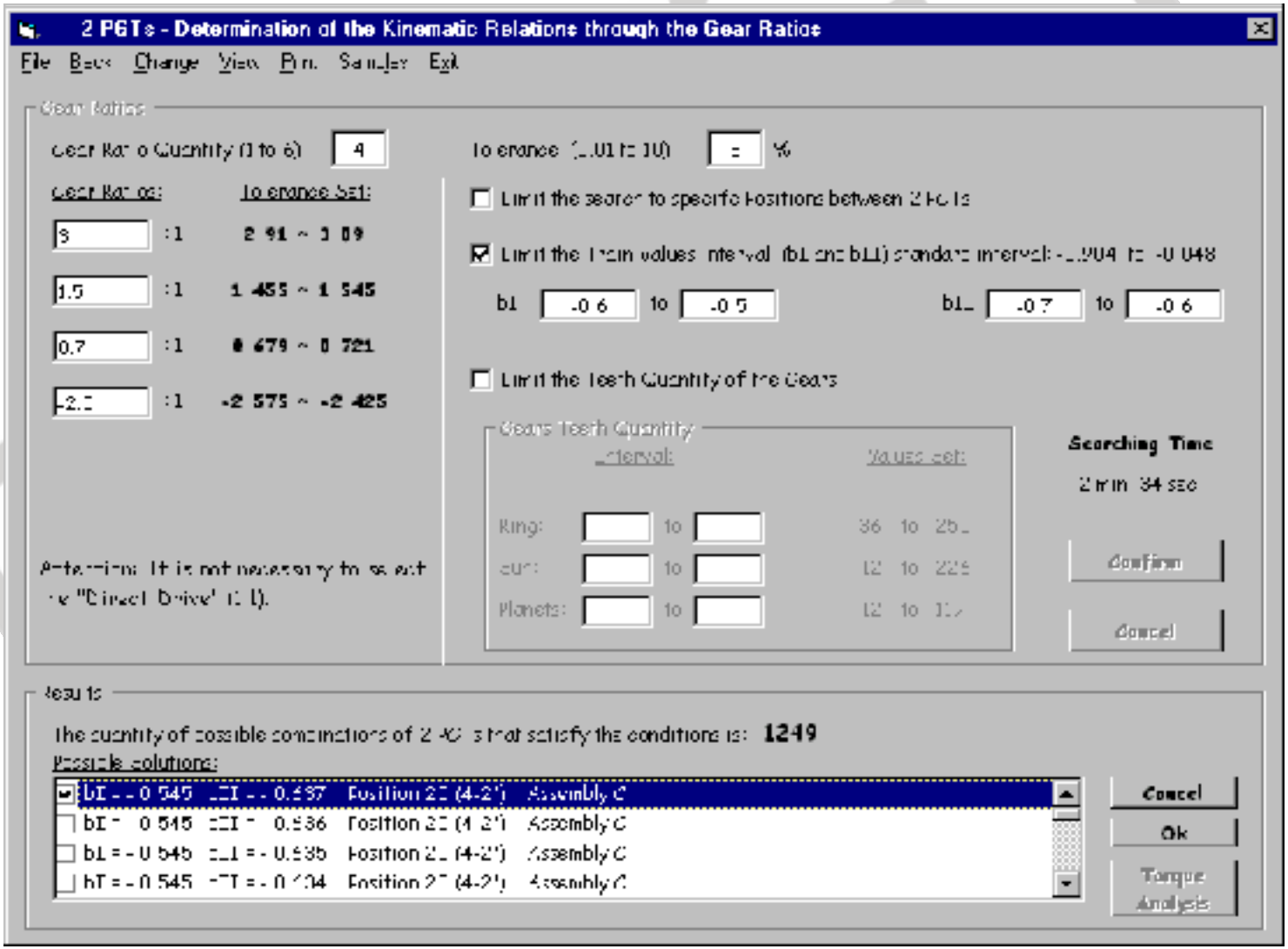

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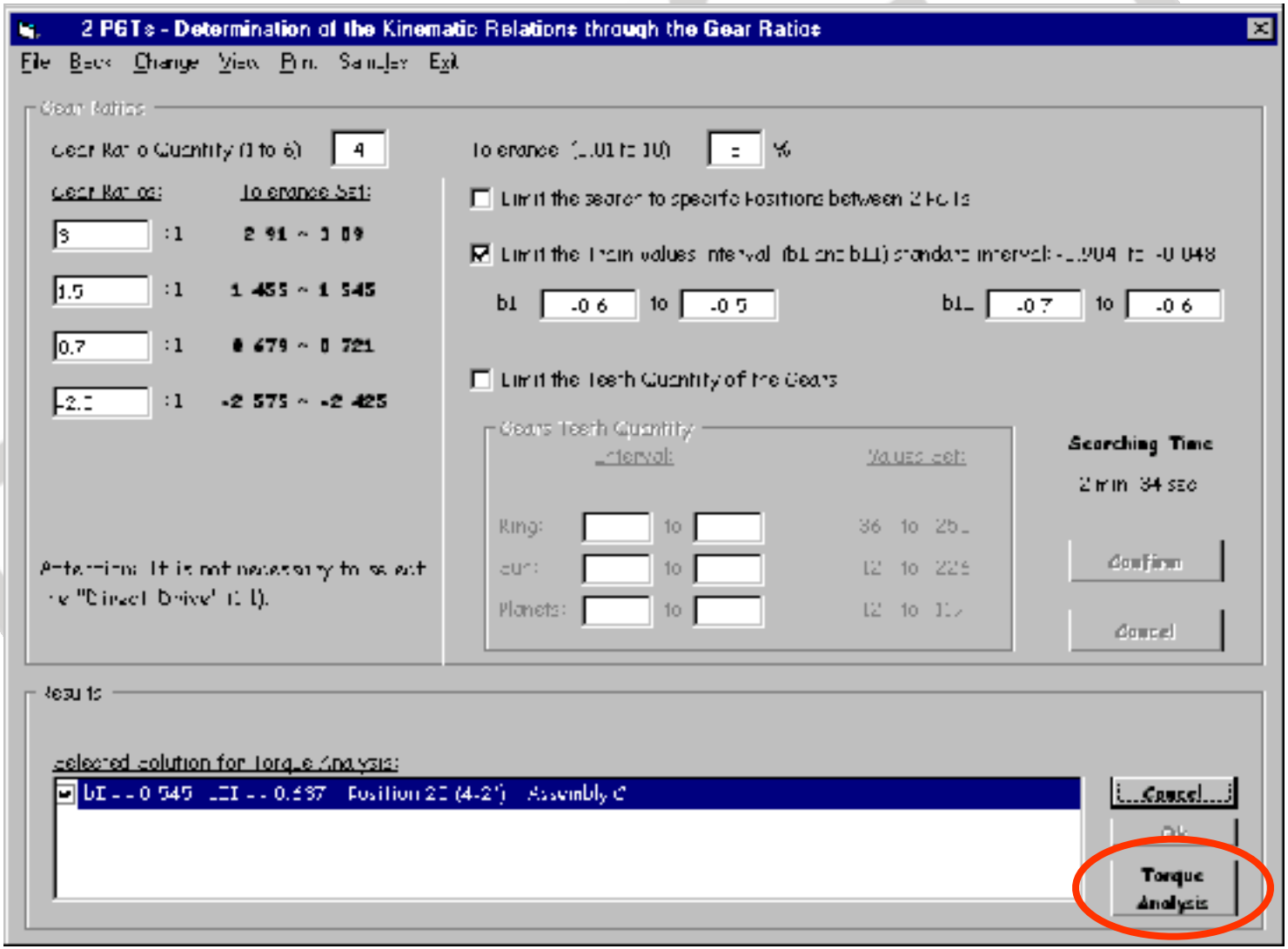

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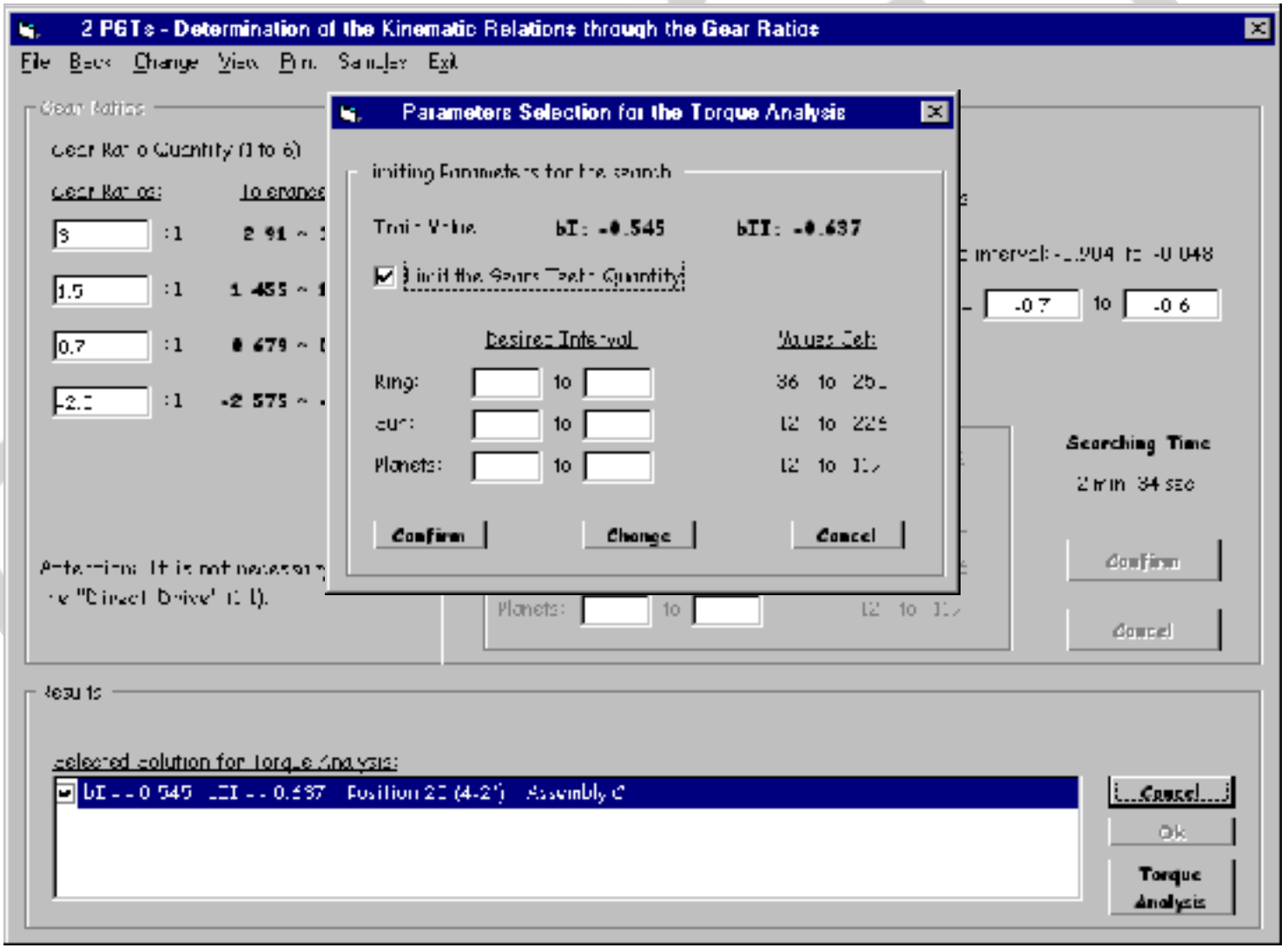

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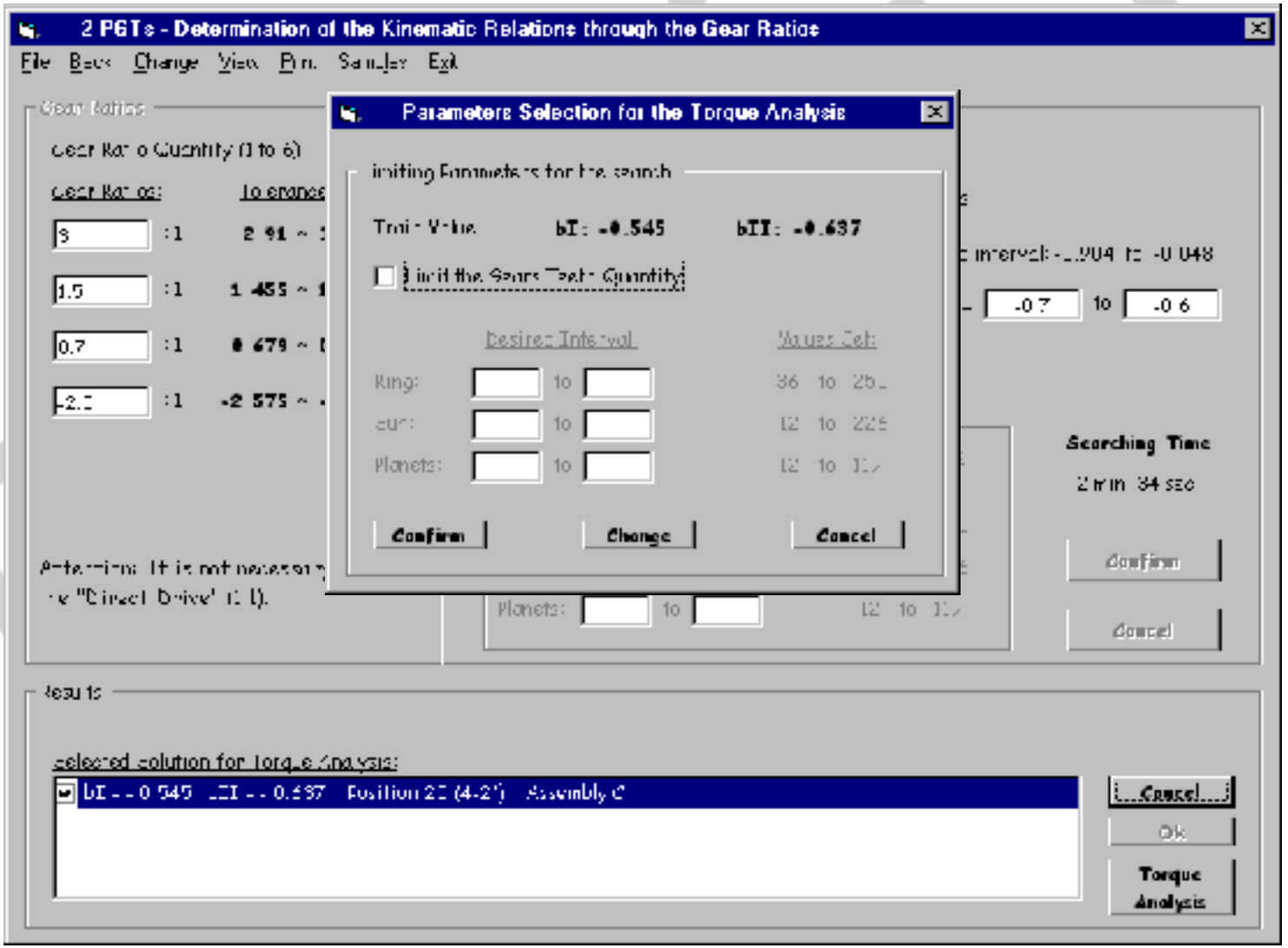

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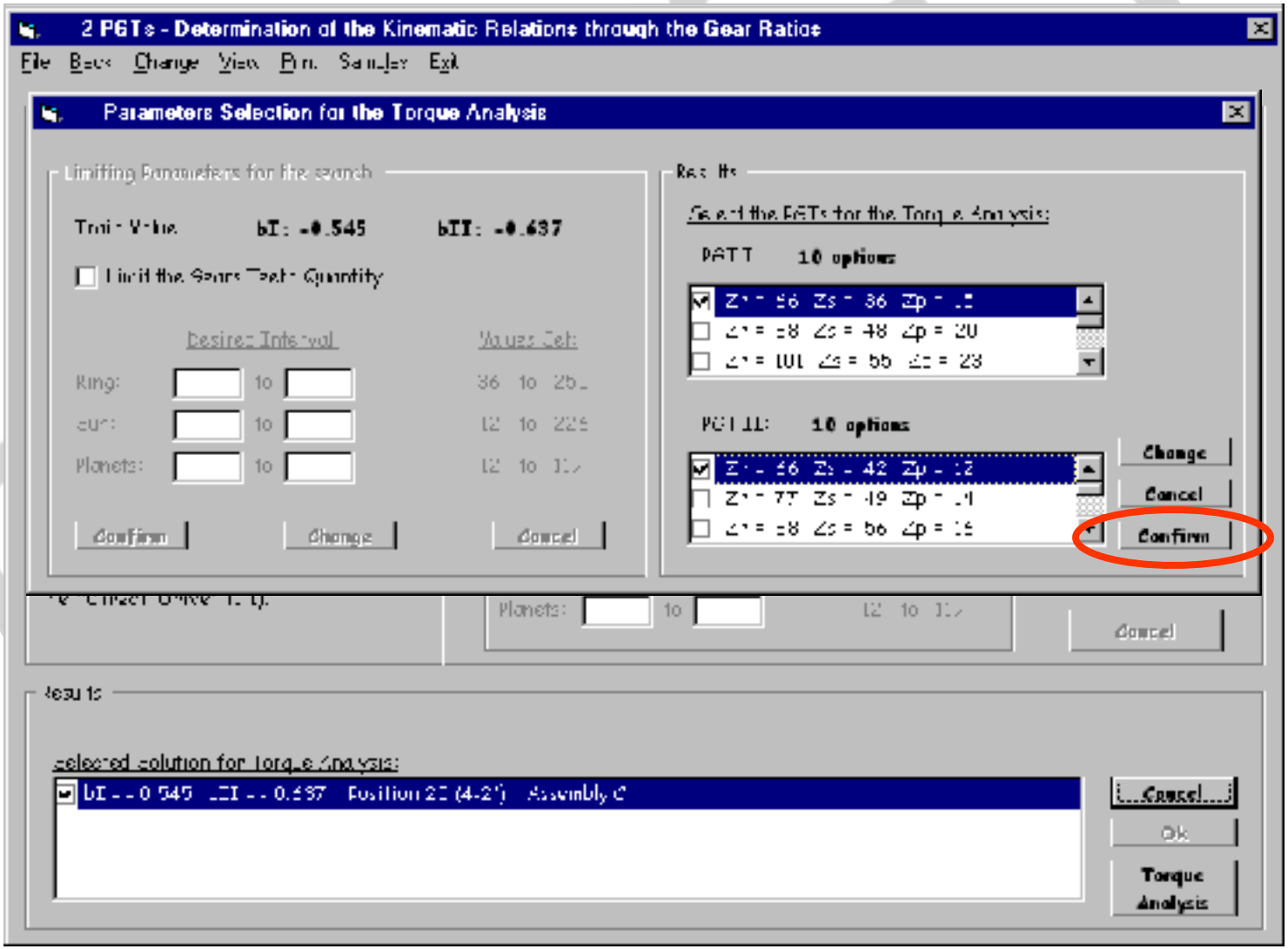

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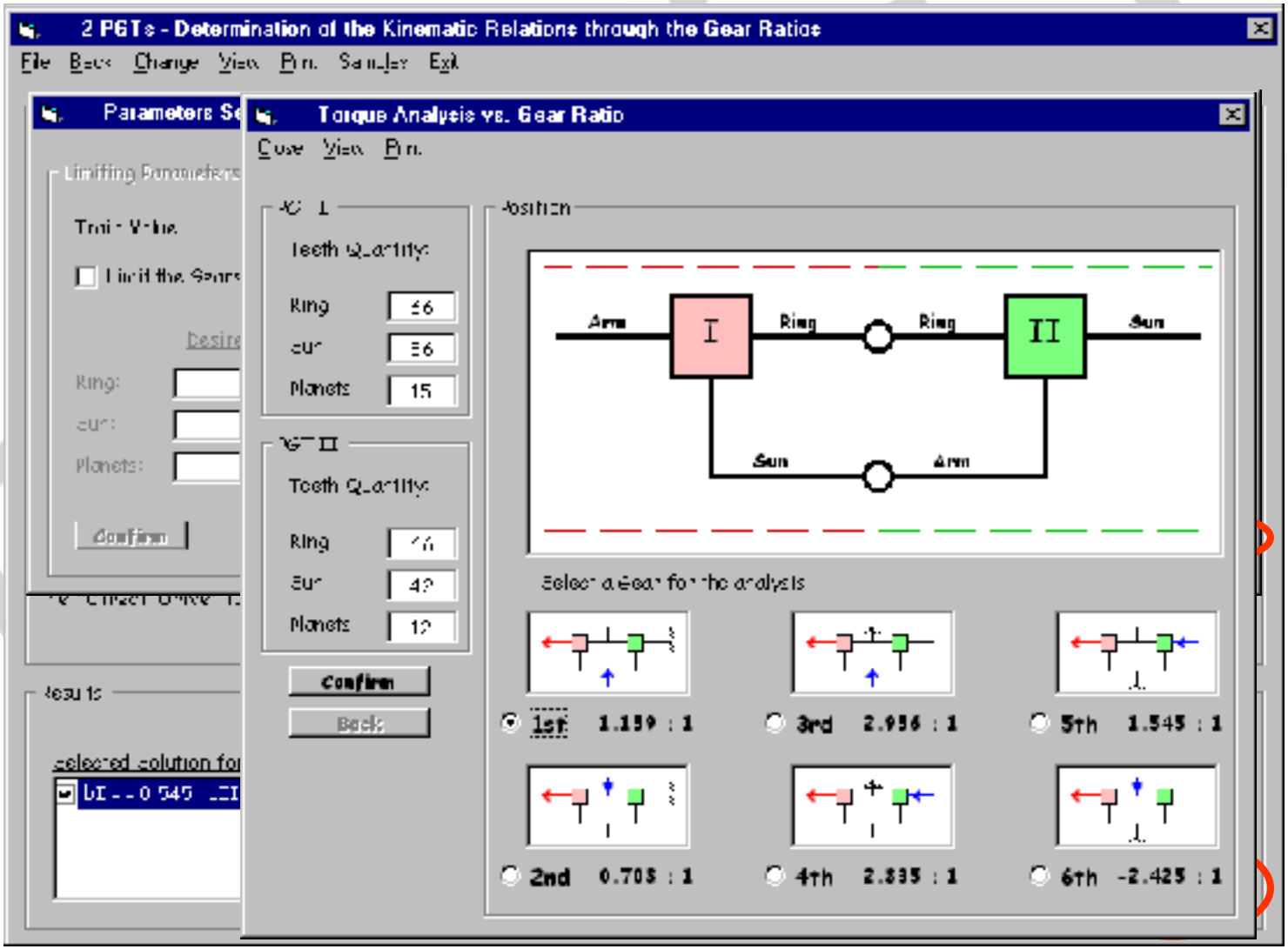

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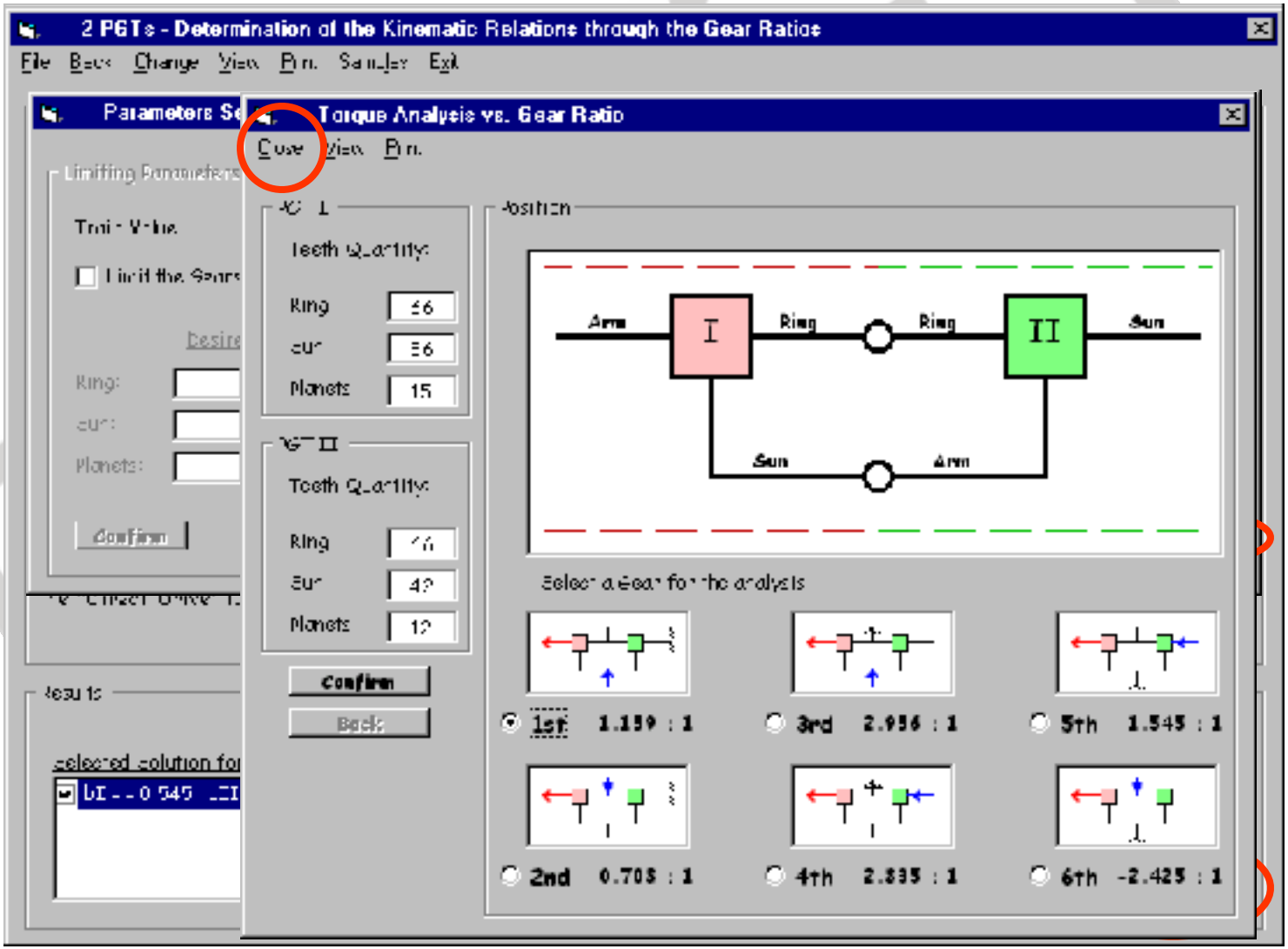
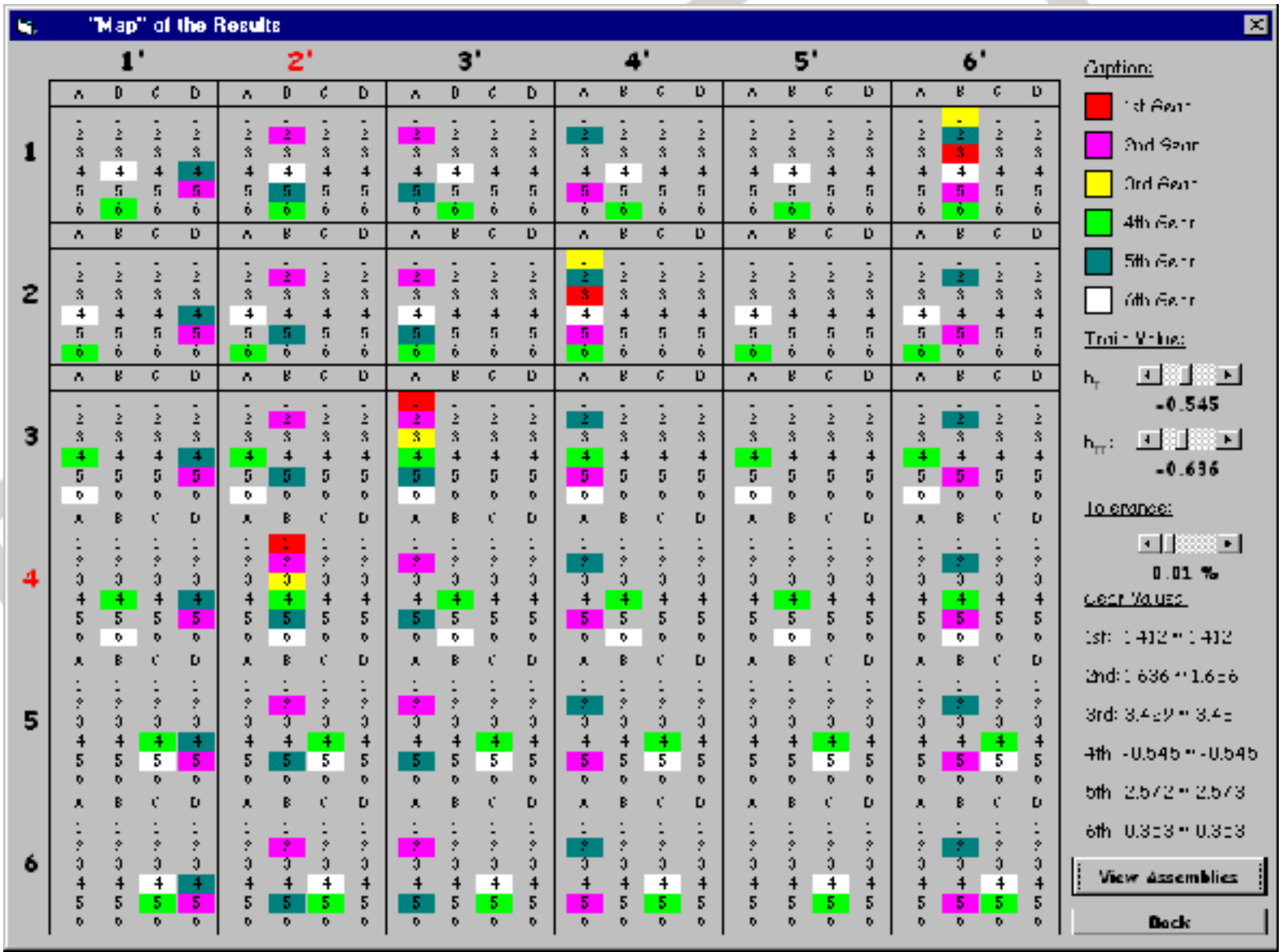
Software TEPiciclo – Transmissão



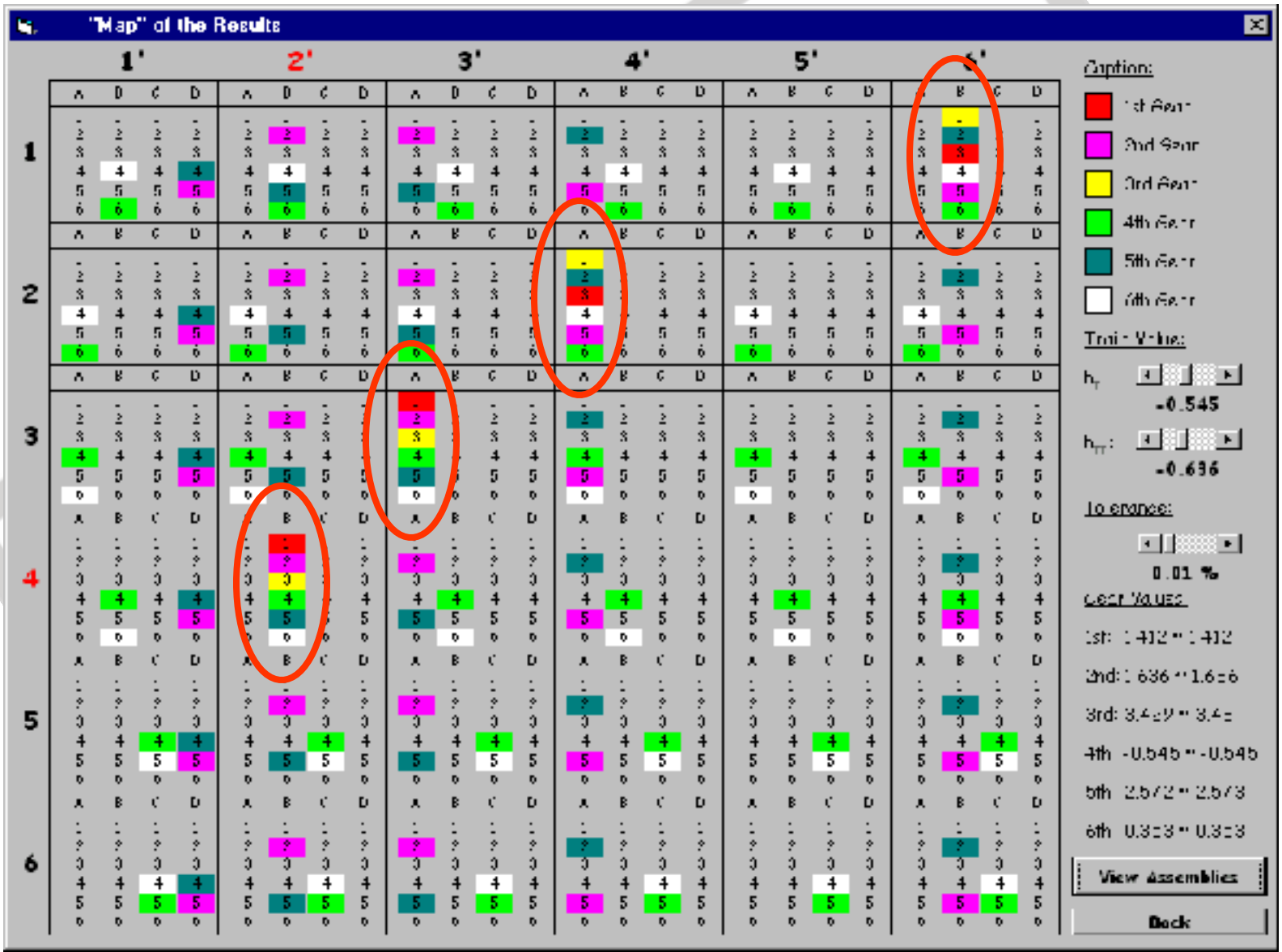
Exemplo 2 TEPs: Síntese

Software TEPiciclo – Transmissão



Exemplo 2 TEPs: Síntese

Software TEPiciclo – Transmissão



Transmissões Veiculares

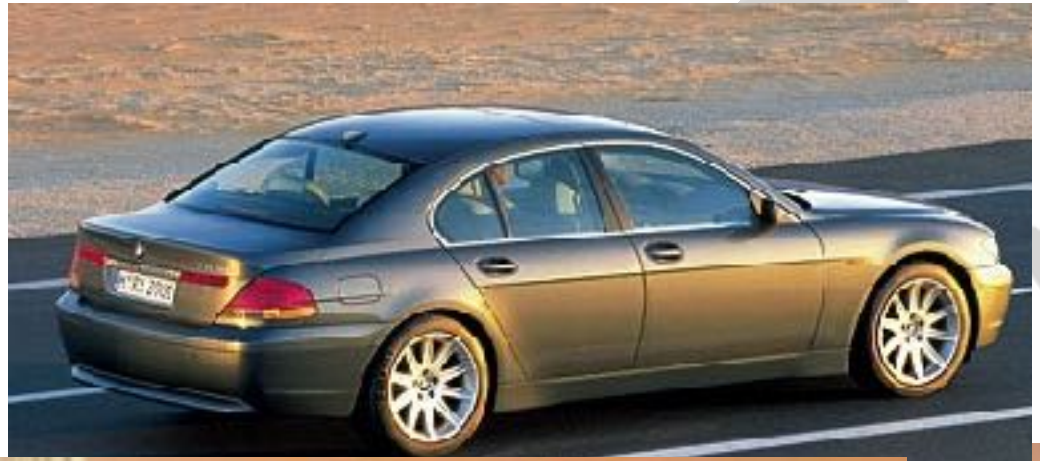
Transmissão Automática

- 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

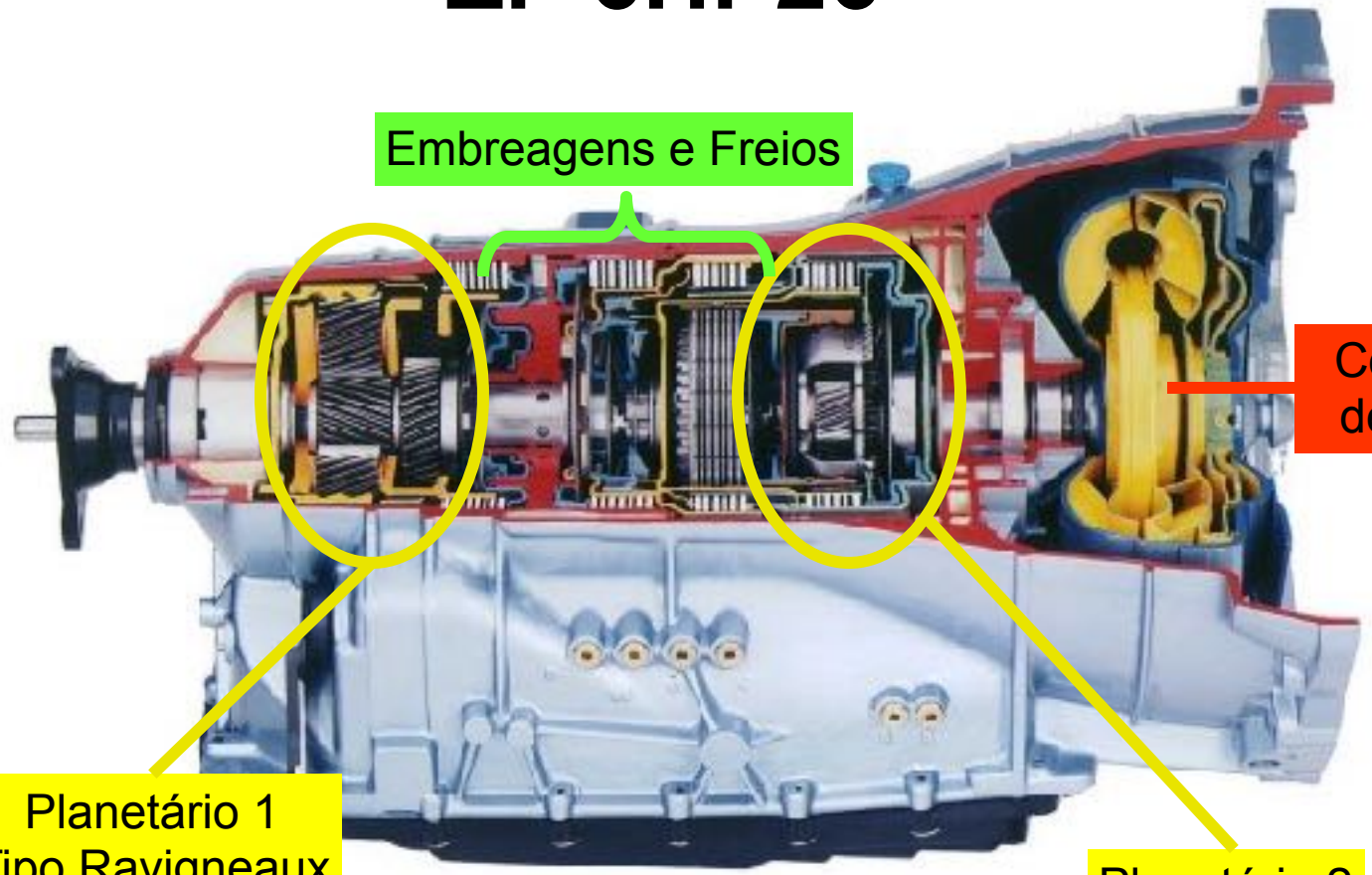


BMW 7 Series
Sedan

Transmissões Veiculares

Caixas ZF

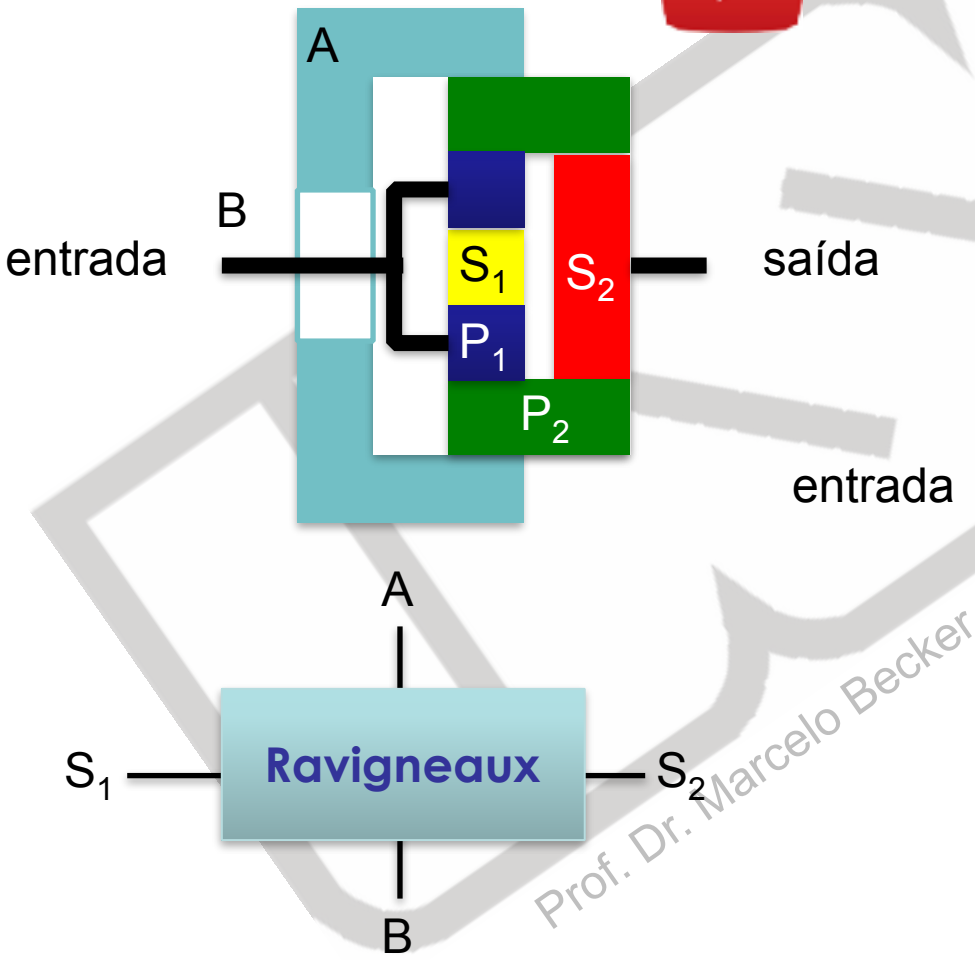
ZF 6HP26

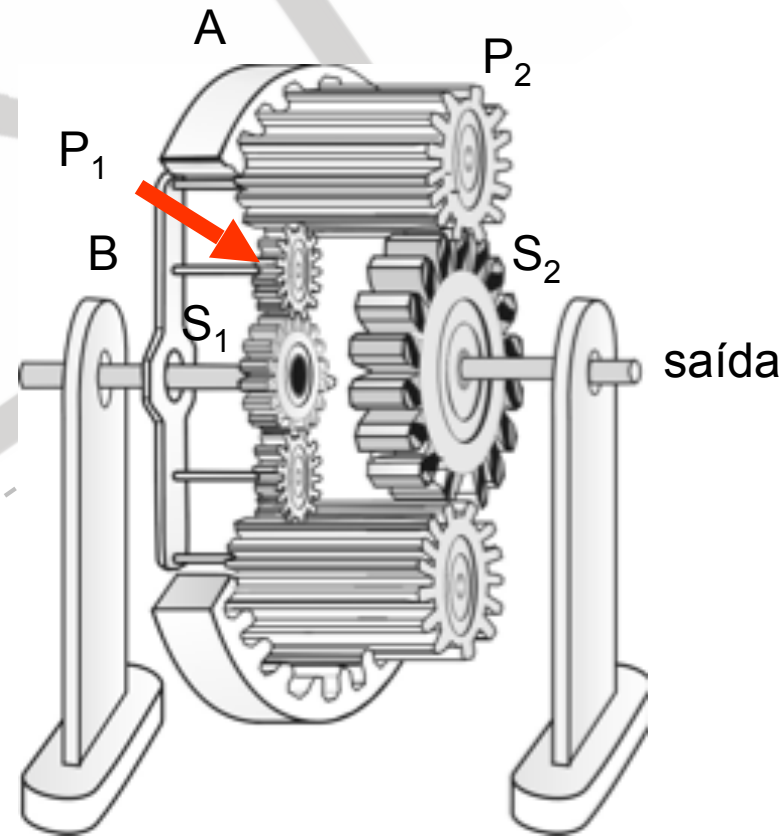


Transmissões Veiculares

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
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