

Catenary Risers

Analytical approaches

Brasil – Japan Cooperative Courses

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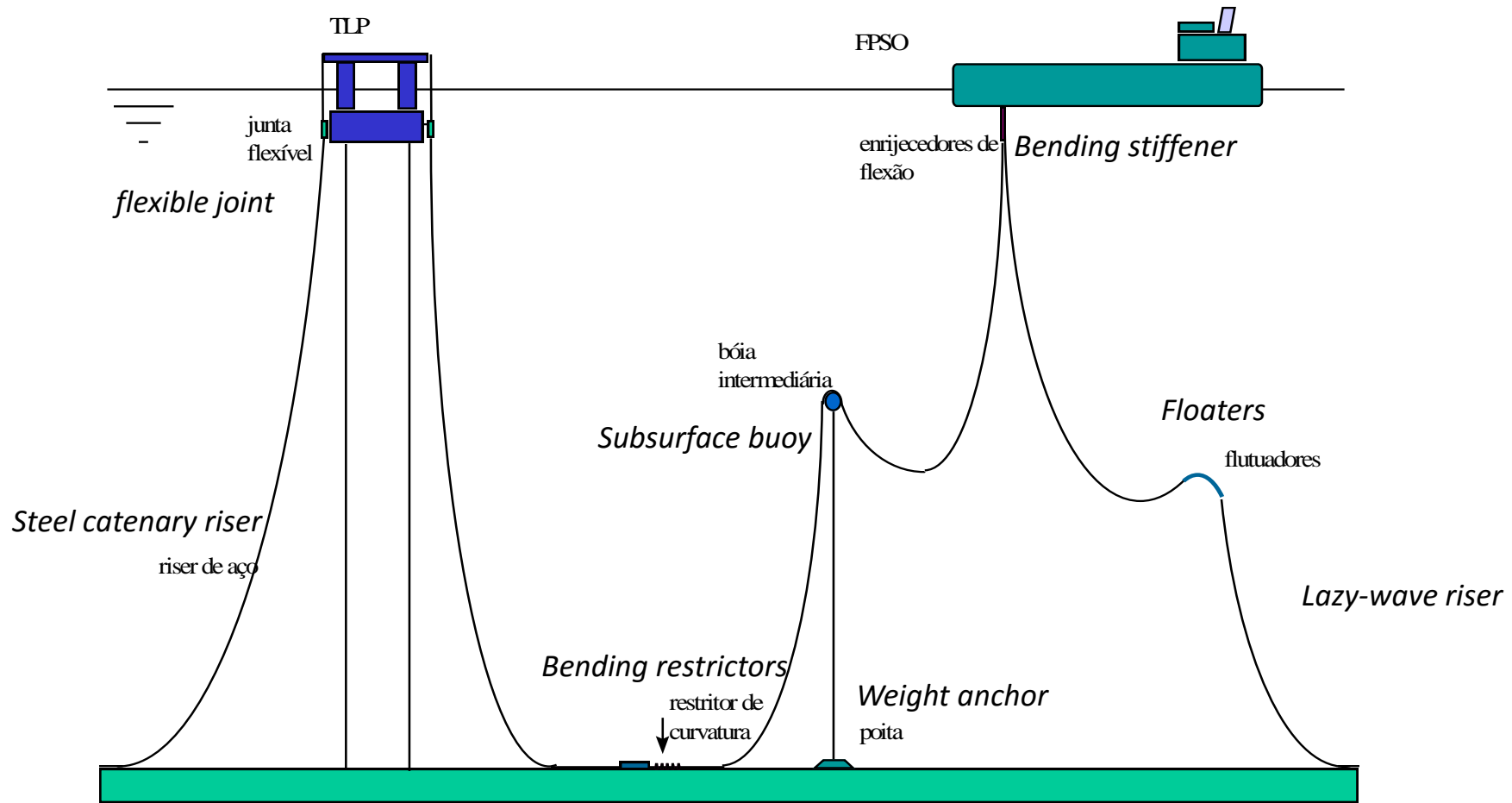
LMO - Offshore Mechanics Laboratory

Escola Politécnica

University of São Paulo

Brazil

Catenary lines



Riser Dynamics research scenario

- **Structural dynamics:**
 - **Formulation and numerical methods:** **On going**
 - Nonlinear boundary conditions at riser top: *OK*
 - Nonlinear boundary conditions a TDZ: *on going*
 - Riser-soil elastic interaction: *OK*
 - Riser-soil nonlinear contact interaction: *on going*
 - **Clashing and impact loading:** **on going**
 - **Instabilities and post-critical behaviors:** **on going**
- **Hydroelastic interactions:**
 - **VIV:** **on going**
 - Fundamentals: *still open*
 - Mitigation: *on going*
 - Multiple scales nonlinear interactions: *still open*
 - **Wake interferences and instabilities:** **on going**
 - **Internal flow interactions:** **on going**

Basics on Catenary Risers - *Analytical approaches*

Schedule and outline

Date	Lecture	Theme	Topic	File
June 6th 2016	1	Global Analysis	Statics	Lecture SCR CPesce #01 ^a
			Dynamics	Lecture SCR CPesce #01B
			Modal Analysis	Lecture SCR CPesce #01C
June 8th 2016	2	Local Analysis at TDZ and TOP	TDZ Kinematics	Lecture SCR CPesce #02
			TDZ 'dynamics'	
			Linear soil effect	
			TOP Local 'dynamics'	

References and further reading

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13. Pesce, C.P. Riser Dynamics: experiments with small scale models. *LabOceano - Ten-Years Anniversary Celebration Workshop.* April 29-30, 2013, Rio de Janeiro, Brazil, 2013.
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Research on Riser Dynamics at University of São Paulo

- VIV on:**
- Flexible Risers
 - Steel Catenary Risers
 - Umbilical
 - Every slender body operating at offshore scenario



Analytical

VIV VIM

Numerical

Experimental



Breadth	108m
Depth	55.00m
Draft (light)	23.00m
Draft	42.00m
Displ.	372,000t
Aspect ratio	$0.21 < L/D < 0.39$
Design life	30 years

Cooperative Applied Research

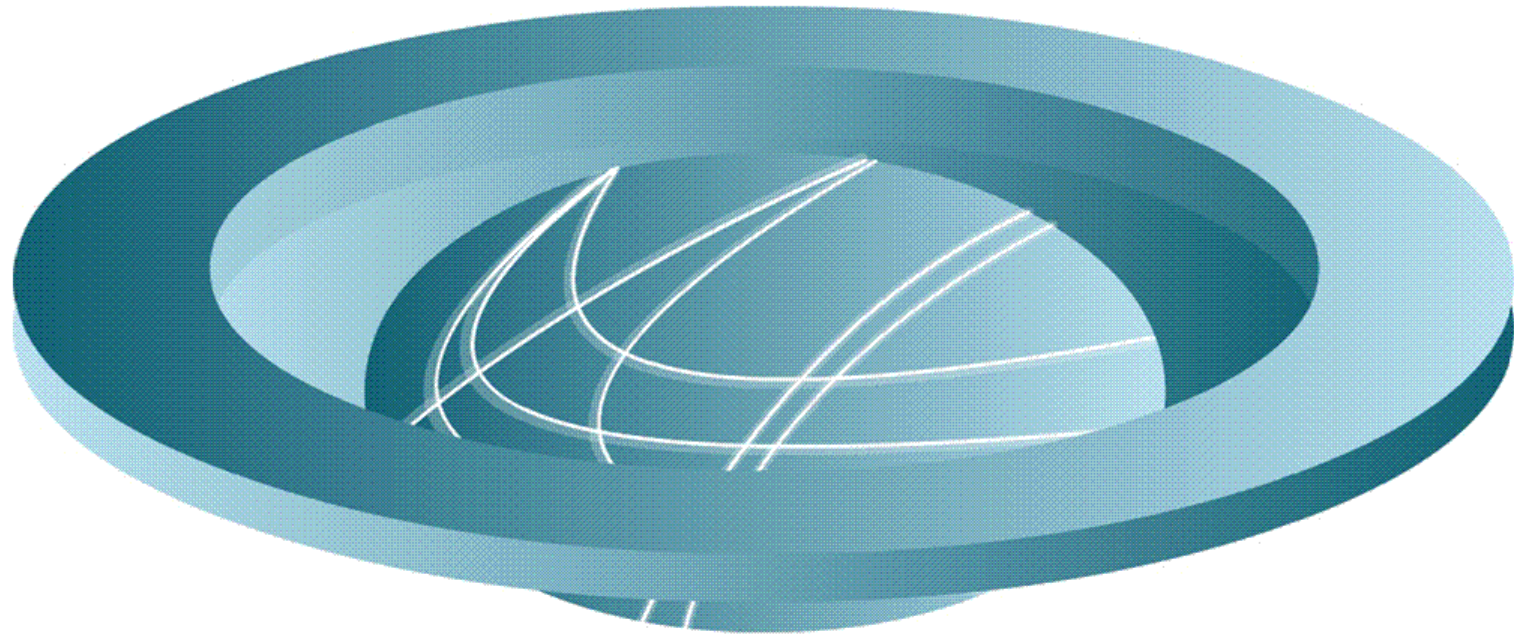
Based on:

- Cooperative Applied Research
- Graduate Studies
- Undergraduate Education

Faculty	Department	Laboratory	Expertise
Celso Pesce	Mechanical	LMO	Ocean Engineering
Clóvis Martins	Mechanical	LMO/NDF	Computational Mechanics
Roberto Ramos	Mechanical	LMO	Structural Mechanics
André Fugarra	UFSC	LMO/TPN	Ocean Engineering
Gustavo Assi	NA & Ocean Eng	LMO/TPN	Ocean Engineering
Kazuo Nishimoto	NA & Ocean Eng	TPN	Offshore Systems Design
Eduardo Tannuri	Mechatronics	TPN	Mechatronics & Control
José Aranha	Mechanical	NDF	Fluid Dynamics
Julio Meneghini	Mechanical	NDF	Fluid Dynamics
Alexandre Simos	NA & Ocean Eng	TPN	Marine Hydrodynamics
Claudio Ruggieri	NA & Ocean Eng	NAVFRAC	Fracture Mechanics
Jorge Baliño	Mechanical	NDF	Fluid Dynamics
Jurandir Yanagihara	Mechanical	LETE	Termo Sciences
Carlos Mazzilli	Civil	LMC	Structure Dynamics
Guilherme Franzini	Civil	LMO	Structure Dynamics
Alfredo Gay Neto	Civil	LMC	Computational Mechanics

Acknowledgements





LIFE & MO

**FLUID-STRUCTURE INTERACTION AND
OFFSHORE MECHANICS LABORATORY**