PUC-Rio

Pipeline Engineering

Research and Education

(2024)

The Campus at Gavea

The University

- Founded in 1941
- Excellence in education & research
- Leadership role in Brazil
- Four Centers:
  - Center for Human Sciences
  - Center for Social Sciences
  - Center for Science and Technology
  - Medical Center
- High quality undergraduate, graduate and extension programs:
  - 11,000 undergraduate students
  - 2,400 graduate students
  - 3,000 extension students
  - 1,000 foreign exchange

CENTER FOR SCIENCE AND TECHNOLOGY - CTC

- CTC is ranked one of the best among R&D centers in Brazil
- Highly multidisciplinary research environment
- The center groups all science and engineering departments:

–Chemistry
–Mathematics
–Physics
–Computer Science
–Civil Eng.
–Electrical Eng.
–Industrial Eng.
–Materials Eng.
–Mechanical Eng.
–Telecom. Institute
–Technology Institute
–Energy Institute

CENTER FOR SCIENCE AND TECHNOLOGY - CTC

- 2,600 undergraduate and 1,100 graduate students enrolled in the Center
- About 180 full-time faculty, all holding doctoral degrees from leading universities in the world
- International cooperation with universities in Europe and the US
- Strong basic and applied research activities

PIPELINE ENGINEERING PROGRAM

- Extension (Continuing Education – Postgraduate Certificate)
  - 365 hours plus monograph (18 plus 6 months)
  - Typical class with 50-60 students
  - About 400 graduate students since 2000
- MSc & DSc Graduation in Mechanical Engineering with thesis on a specific topic of pipeline interest
  - 24 or 48 total graduate credits, respectively
- Partnership with Petrobras in the foundation of CTDUT - Technology Center in Pipelines
- Professional accreditation at CREA-RJ – Engineering and Architecture Council of State of Rio de Janeiro

PIPELINE ENGINEERING PROGRAM

- Objective. Training of practicing engineers to understand and work in areas associated with the transport of oil and gas, including: design, construction, installation, maintenance, operation and integrity of onshore and offshore pipeline systems.

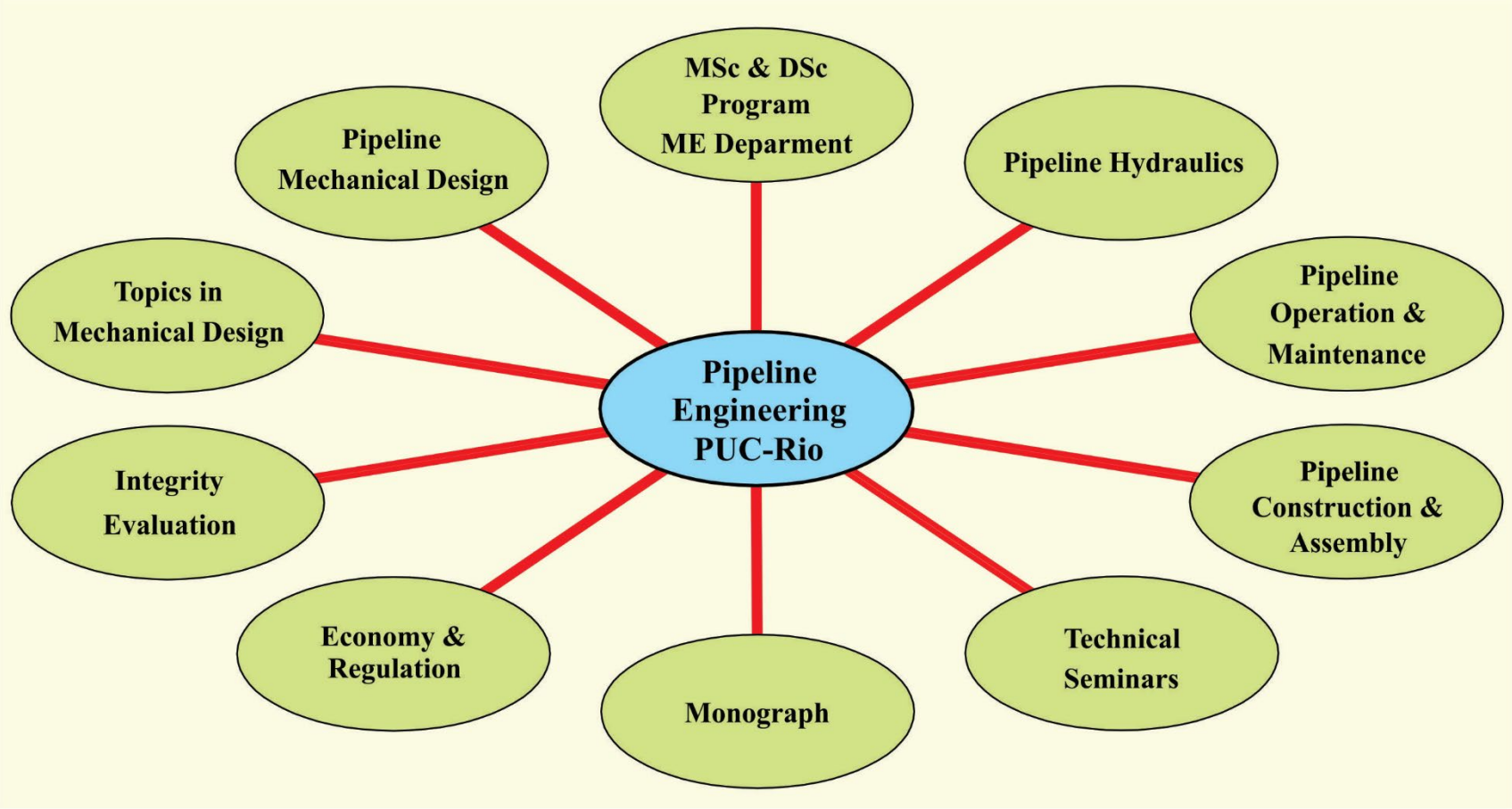
- Teaching. The Extension program consists of lectures on six subjects, seminars, field trips and personal supervision of monographs covering relevant topics in pipeline engineering. The program is presented by a mix of permanent professors from the University and a group of highly qualified visiting lecturers from industry.

- Duration. The course is offered online every 18 months in three semesters, August-December (2024), March-July, and August-December (2025), two classes per week (on Saturday´s), for a total of eight hours per week. Supervised monographs occur normally from March to August, after the class period, ending in September.

PIPELINE ENGINEERING PROGRAM

- Mechanical Design of Pipelines (60 hours)
- Thermal Hydraulics in Liquid and Gas Pipelines (60 hours)
- Topics in Pipeline Design (45 hours)
- Structural Integrity Assessment of Pipelines (60 hours)
- Topics in Pipeline Operation (68 hours)
- Topics in Pipeline Construction, Installation and Operation (45 hours)
- Economy & Regulation (National & International)
- Topics on Artifitial Inteligence and Energy Transition Problems
- Pipeline Engineering Seminars (22 hours)

PIPELINE ENGINEERING PROGRAM

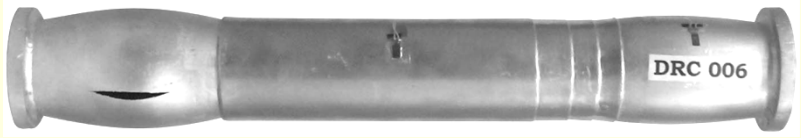


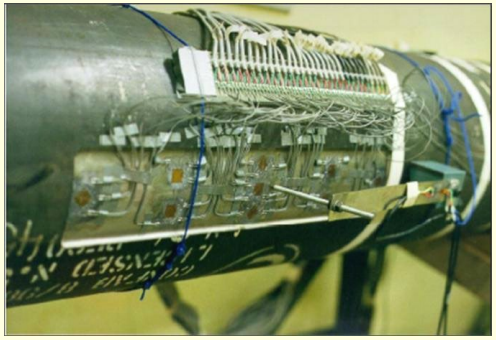
RESEARCH ACTIVITIES

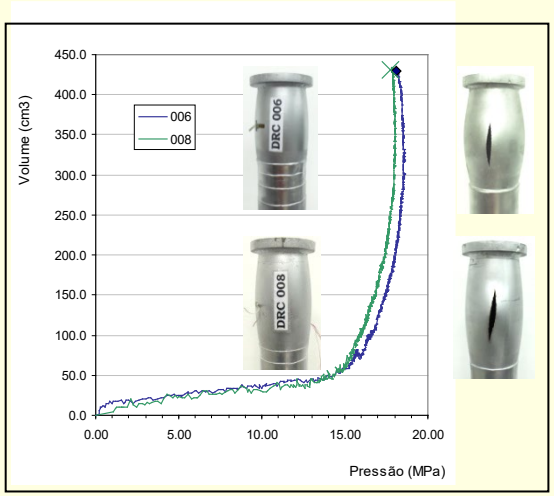
- Pipeline integrity
- Development of intelligent pig for pipeline inspection
- High-yield strength steels for pipeline applications
- Soil-pipeline interaction studies
- Expert systems for pipeline safety
- Application of optical fiber sensors
- Wax deposition and heat transfer in subsea pipelines
- Pipeline pigging and wax removal simulation
- Pipeline thermo-hydraulic simulation

Structural Integrity

- Structural integrity evaluation
- Risk analysis
- Risk-based inspections
- Repairs and reinforcements with composite materials







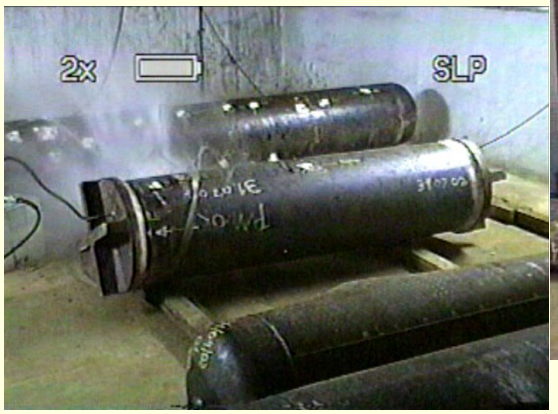
Structural Integrity

International Joint Industry Project

MIT – A research project aimed at improving the prediction of failure of pipelines containing interacting corrosion defects.

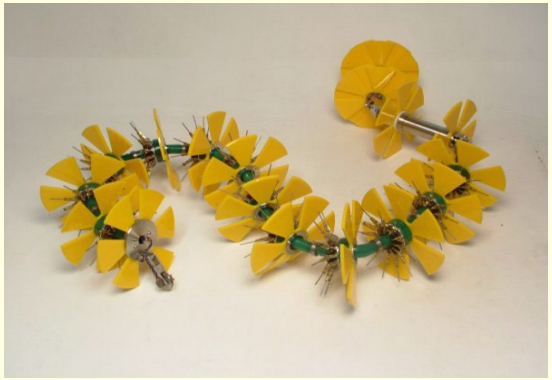
Sponsors

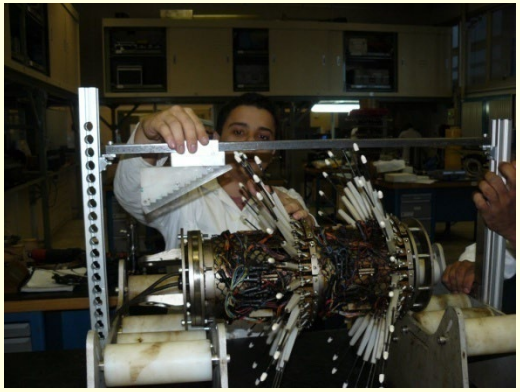
Petrobras
Tenaris – CONFAB
DNV
Shell
Statoil
TransCanada

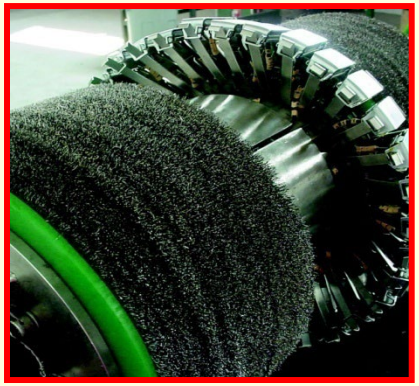


Center for Inspection Technology

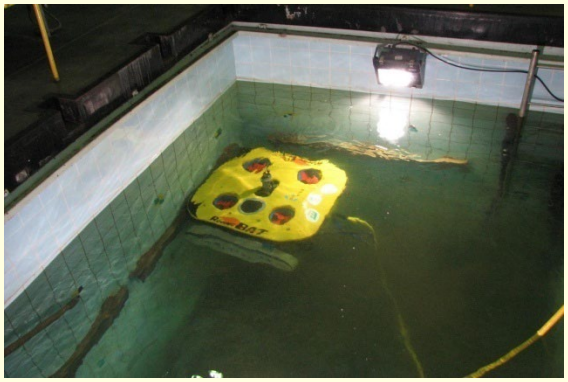
- Development of inspection tools for pipelines, ships and structures
- Instrumented PIGS for pipeline inspection







ROV for ship hull inspection

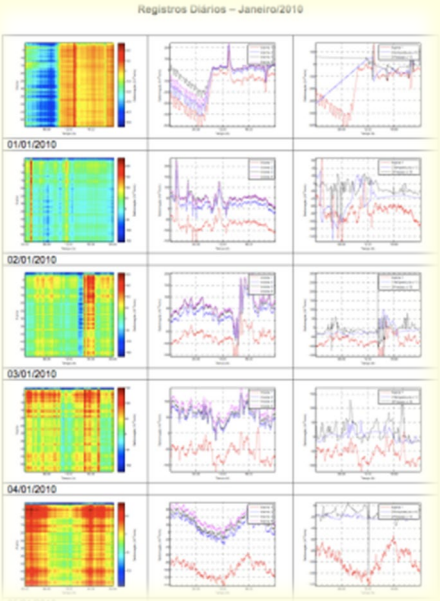


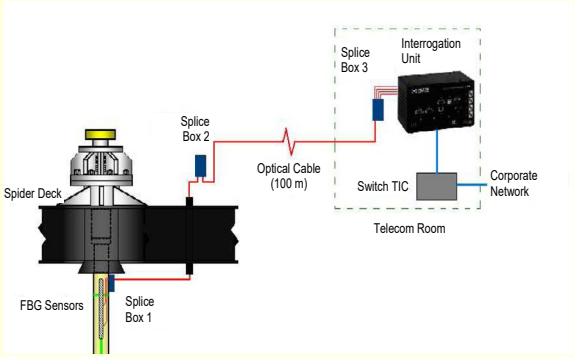
Optical Fiber Sensors Laboratory

Fiber Optic Downhole Gauges

Optical Fiber Sensors Laboratory

Structural Health Monitoring of Flexible Risers

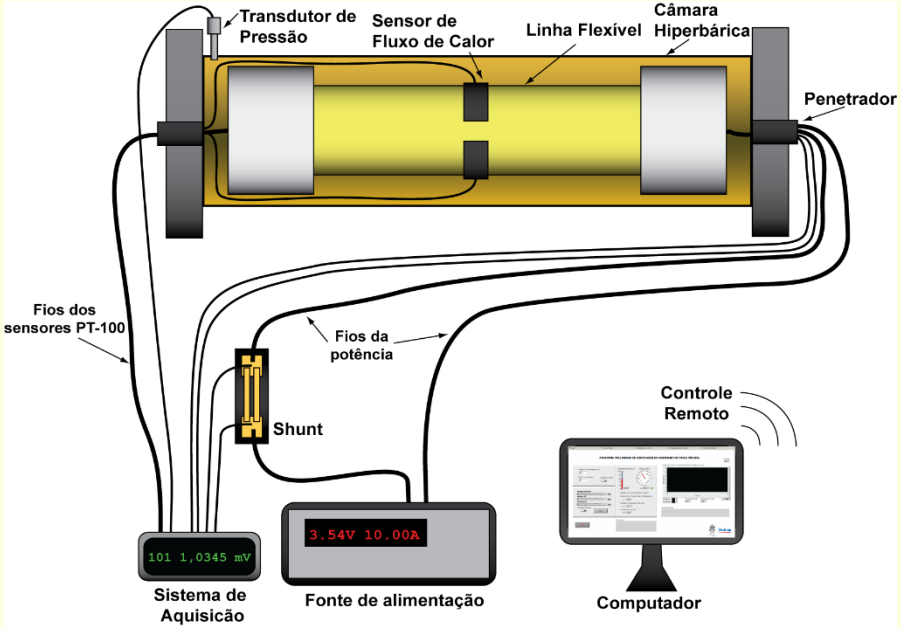




Flow Assurance Group

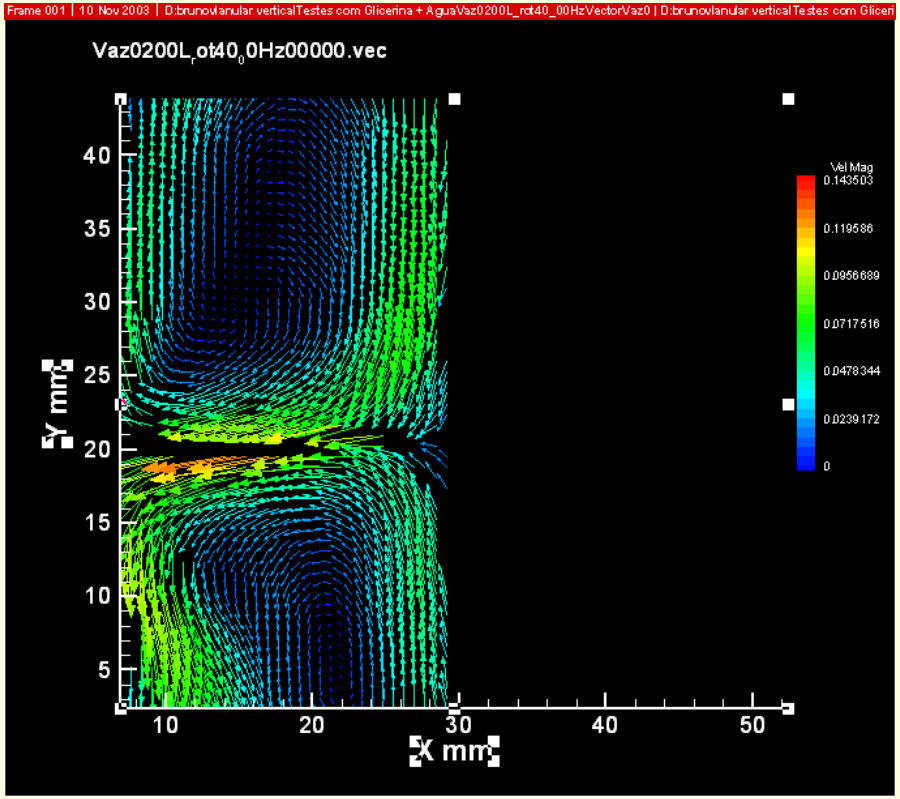
Fluids Engineering Laboratory (Mechanical Engineering Department)

Heat transfer in subsea flow lines



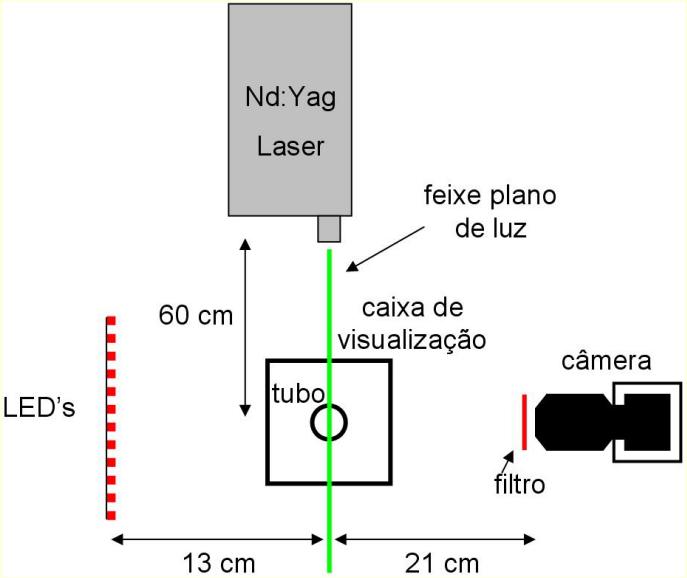
Fluids Engineering

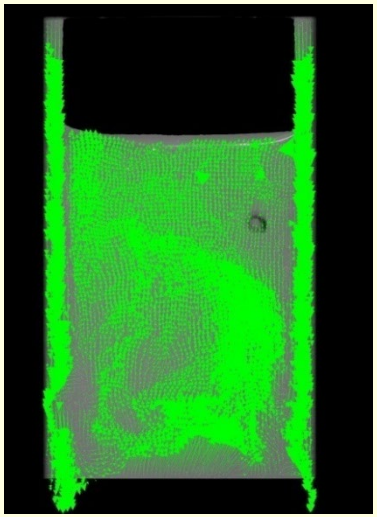
PIV - Flow visualization through annular region with rotation: well drilling model



Fluids Engineering

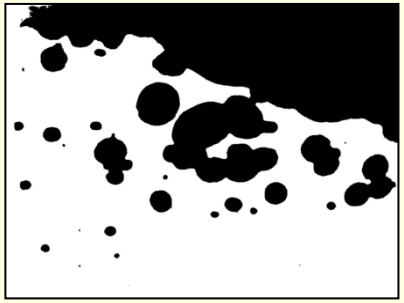
Laser-based measurements in two-phase flow

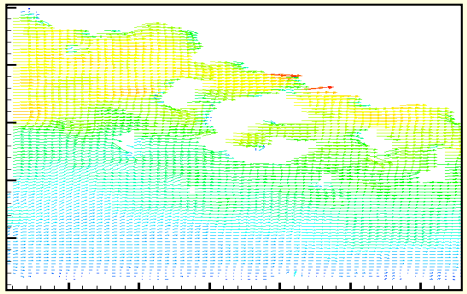




Ascending Taylor Bubble

Horizontal Slug





CTDUT – University-Industry Cooperation

CTDUT – Technology Center in Pipelines

- Full scale industrial laboratory for R&DI, training and certification
- Testing pipeline: 12” – 2.600m
- Testing pipeline: 14” – 100m
- Integrity, cathodic protection laboratories and others
- Access to national and international companies, universities and institutions
- 35 km away from PUC-Rio

Startup Companies (Oil & Gas Sector)

2000

2003

gavea sensors
measurement solutions

INSTITUTO GÊNESIS

2006

[A]TI]VA]]]
TECNOLOGIA & DESENVOLVIMENTO

Startup Companies (Oil & Gas Sector)

2008

I-DUTTO

I-Dutto: Identificação Eletrônica

2009

PRIMA 7S
Integridade Estrutural

ICSS
Completação Inteligente

WSN
Sistemas de Monitoramento

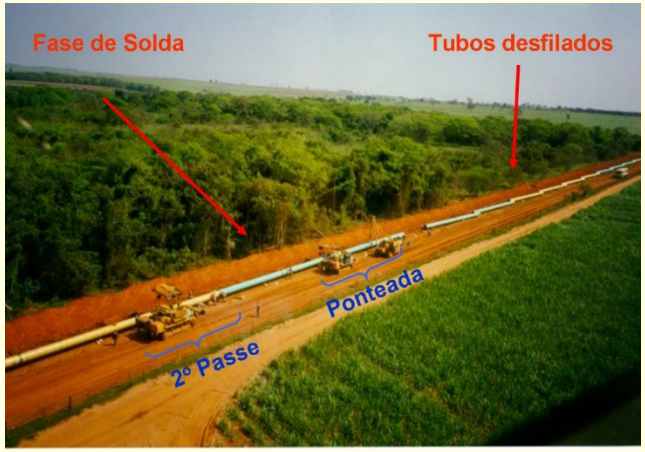
2010

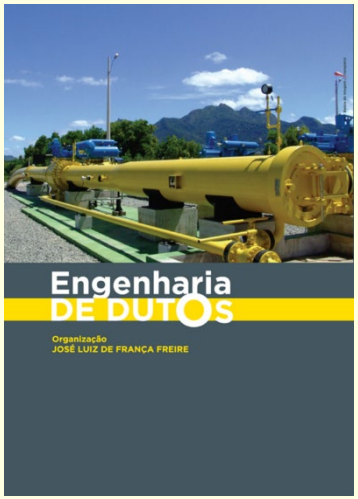
monflex

OURO NEGRO
Tecnologias

Reference Book – Handbook of Pipeline Engineering

- ABCM, PUC-Rio, Transpetro - Petrobras
- Editor: Prof. José Luiz de França Freire, PhD – PUC-Rio
- New Handbook of Pipeline Engineering, Edited by Sringer Cham
- 47 Chapters by renowned specialists with over 1300 pages
- New 2nd Edition: published - May 2024
- Organized by José Luiz de França Freire, Marcelino Gomes and Marcello Rennó





Thank You!

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Pipeline Engineering Course: http://engdutos.usuarios.rdc.puc-rio.br/