Thesis Topic: Bioinspired Soft Robotics: Earthworm Locomotion for Confined Environments

What's this about?
This thesis investigates how hydrostatic skeleton principles, observed in earthworms and other soft-bodied organisms, can be applied to the design of a bioinspired soft robot capable of navigating confined pipeline environments. The work will focus on the mechanical design, fabrication, and experimental testing of multi-segment soft robotic modules. Research will address how inter-segment angles, anchoring strategies, and material compliance influence locomotion efficiency. Special attention will be given to drift and slippage in inclined and vertical pipes, where gravity, friction, and segment deformation play critical roles.

What will you learn?

- **Soft Robotics Design & Fabrication:** Practical experience in designing, manufacturing, and testing soft robotic actuators and modular segments.
- **Bioinspired Locomotion Strategies:** Understanding how earthworm hydrostatic skeletons achieve movement and how these principles translate into robotic applications.
- **Experimental Validation:** Skills in designing and conducting experiments to evaluate locomotion efficiency in dry, wet, and slippery pipeline conditions.
- **Multidisciplinary Perspective:** Experience at the intersection of biomechanics, mechanical engineering, and robotics.

Why is this important?
Scientific Insight: Provides new understanding of how hydrostatic motion can be engineered into robotic systems.

Practical Applications: Enables the development of robots for inspection, maintenance, and repair in pipelines and other confined spaces.

Mechanical Innovation: Establishes a foundation for future soft robots that combine adaptability, stability, and efficiency in environments where traditional rigid robots fail.

Broader Impact: Advances bioinspired robotics by demonstrating how natural locomotion strategies can solve real-world engineering challenges.

Supervisor: Dimitrios Xydianos