DIPARTIMENTO DI INGEGNERIA
STRUTTURALE E GEOTECNICA

SAPIENZA
UNIVERSITÀ DI ROMA

# AVVISO DI SEMINARIO

## Prof. Amy Shen

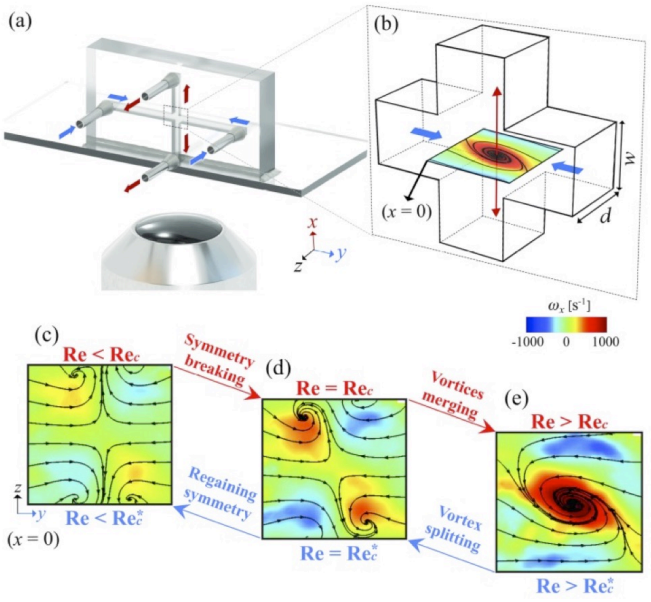
Okinawa Institute of Science and Technology (Japan)

**Venerdì 12 Aprile 2019, h 15.00**

Sapienza Università di Roma, Dipartimento di Ingegneria Strutturale e Geotecnica
Facoltà di Ingegneria Civile e Industriale, Via Eudossiana 18
**Aula 32**

## New observations of hydrodynamic instabilities around junctions by using microfluidics

Microfluidics has emerged as a powerful platform of investigating flow instabilities at small lengh scales, as it provides access to regimes of low inertia and high elasticity and allows for the study of purely elastic flow instabilities and elastic turbulence, which occur at low Reynolds numbers but high Weissenberg numbers. By employing a state-of-the-art microfabrication technique (selective laser-induced etching) to fabricate glass microfluidic devices, we create platforms for discovering new insights on flow instabilties of complex fluids, assisted by a number of flow visualization and diagnostic techniques.




In this talk, I will focus on an example of using cross-slot microfluidics to explore how fluid elasticity affects inertial flow instability: Simple fluids often display flow instabilities involving the production of vortices. However, studying how polymers and vortices interact is challenging because vortices generally fluctuate significantly and polymer effects at low concentrations can be subtle. A better understanding of these interactions is needed to optimize the use of polymer additives in industrial and biomedical applications ranging from lab-on-a-chip devices to large pipelines. We fabricated unique glass microfluidic devices containing junctions to make measurements on a single, steady, stationary vortex by direct visualization at high frame rates. By adding increasing amounts of a flexible polymer to water-based solvents, we discovered that the addition of the polymer is destabilizing and lowers the threshold flow rate needed for vortex formation. At the same time, we found that the polymer significantly reduces the strength of the resulting vortex. Our discoveries provide new insight regarding the competing effects of inertial and elastic instabilities on vortex formation and dynamics at small length scales. If time permits, I will also show some ongoing work of flow around microfluidic cylinders using both polymer and surfactant wormlike micellar solutions.

*Amy Shen leads the Micro/Bio/Nanofluidics Unit at Okinawa Institute of Science and Technology in Japan. She was a tenured faculty member in Mechanical Engineering at University of Washington before moving to Japan in 2014. Her research is focused on coupling rheology with microfluidics for fluid manipulation, viscoelastic instabilities, and microfluidic rheometry at small length scales. The primary applications of her work are to biotechnology. Amy is a Member-at-Large of the Society of Rheology Executive Committee (2018-2020), a delegate of the individual Members to the European Society of Rheology Committee (2019-2023), an honor member of Phi Kappa Phi and Pi Tau Sigma. She received the Ralph E. Powe Junior Faculty Enhancement Award in 2003 and the National Science Foundation's CAREER Award in 2007, and she held a Fulbright Professorship in 2013.*