My name is Giusy Mazzone and I am an Assistant Professor in the Department of Mathematics and Statistics at Queen's University.

My research focuses on the analysis of the partial differential equations modeling fluid phenomena, like the Navier-Stokes equations for viscous incompressible fluids, and fluid-structure interaction problems arising when fluids interact with rigid or elastic solids. In the following, you will find some of my current research interests.

Fluid-structure interaction problems. This type of problems are usually modeled by the coupling of the Navier-Stokes equations (for the fluid part) with the Navier equations of linearized elasticity (for an elastic solid) and/or with the balances of linear and angular momentum (in case of a rigid body). The "coupling" is given by the boundary conditions at the fluid-solid interface. Questions that we investigate include: existence, uniqueness, stability and asymptotic behaviour of solutions of the governing equations in different physical situations.

Energy harvesting. An energy harvester is a device that converts mechanical energy (usually generated by ambient vibrations, which would be otherwise wasted) to electrical energy. Sources of this "free" mechanical energy could be the motion of vehicles on bridges, buildings' vibrations, ocean waves, or human locomotion. Our objective here is the analysis and optimal design of underwater or wave energy harvesting devices.

Partially dissipative systems. From the point of view of the analysis of partial differential equations, the above problems feature a "dissipative-conservative" interplay because some variables show some decay in time (like the kinetic energy of a viscous fluid), whereas others have constant magnitude (like the angular momentum of a fluid-filled undamped pendulum). This feature arises in many other problems characterized by the coupling of parabolic and hyperbolic partial differential equations. For these equations many definitions of solutions can be given ("strong", "mild", "weak", or "very weak"). We would like to study properties of these solutions like regularity, stability, and asymptotic behaviour, by analyzing the governing equations in different functional settings.

If you find any of these problems interesting or would like to hear more about my research, do not hesitate to contact me at giusy.mazzone@queensu.ca