

# Helmholtz resonator analogue for water waves

L.-P. EUVE<sup>a</sup>, K. PHAM<sup>b</sup>, P. PETITJEANS<sup>c</sup>, V PAGNEUX<sup>d</sup>, A. MAUREL<sup>e</sup>

a. PMMH, ESPCI, Sorbonne Université, Univ. PSL, Univ. Paris Cité, leo-paul.euve@espci.fr

b. ENSTA Paris, kim.pham@ensta-paris.fr

c. PMMH, ESPCI, Sorbonne Université, Univ. PSL, Univ. Paris Cité, phil@pmmh.espci.fr

d. LAUM, Univ. Du Maine, vincent.pagneux@univ-lemans.fr

e. Institut Langevin, ESPCI, Sorbonne Université, Univ. PSL, agnes.maurel@espci.fr

**Mots clés :** Surface waves

## Résumé :

We present a theoretical and experimental study of a resonator of the Helmholtz type for the wave control. The resonator geometry is presented in figure 1. An experimental demonstration of the shielding effect by a belt made of evenly distributed resonators is given. We then provide in-depth analysis of the Fano resonance resulting from the interference between the dock scattering (the background) and the resonant cavity scattering. This is done thanks to space-time resolved experiments which provides the complex valued scattering coefficients and amplitude within the resonator. We provide a one-dimensional model derived in the shallow water regime owing to asymptotic analysis. The model contains the two ingredients of the Fano resonance and allows us to exhibit the damping due to leakage. When adding heuristically the damping due to losses, it reproduces the main features of the resonance observed experimentally (see figure 2). Those results are reported in Euvé et al. [*J. Fluid Mech* **920**, A22 (2021); *MDPI crystals* **111**, 520 (2021)].



Figure 1: Picture of the experiment showing the resonator geometry. The red arrow indicates the direction of the incident wave.

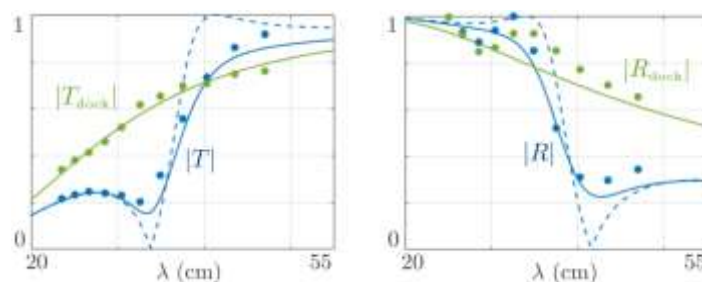


Figure 2: Transmission (left) and reflection (right) coefficient versus the incident wavelength. Circles show the experimental measurements; dashed lines show the numerical results without losses and plain lines the numerical results with losses within the cavity.