Mirrors, waveguides, and cavities
### Basic computational problems for perfectly periodic and defect-based phononic crystals

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Transmission coefficient within a Bragg band gap

\[ T(\omega_0) \approx -8.7n\kappa a \] (dB)

Figure: (a) \( k = \pm \imath \kappa \) at the center of the band gap. (b) Transmission for \( \kappa a = 0.4 \) and \( T_0 = 0.6 \).
Two-port SAW resonator using phononic crystal mirrors

**Figure:** SQ phononic crystal of holes deeply etched in silicon, $d = 6 \, \mu m$ and $a = 10 \, \mu m$. A thin-layer of ZnO is deposited under the interdigital transducers. (b) $D = \lambda$ and (c) $D = 1.25\lambda$ ($\lambda = 23.4 \, \mu m$) [40].
Two-port Lamb wave resonator using phononic crystal mirrors

Figure: SQ phononic crystal of holes is etched in silicon, $d = 17.8 \ \mu m$ and $a = 20 \ \mu m$. The thickness of the silicon membrane is $h = 12 \ \mu m$. Destructive interference is obtained for $D = 1.43 \lambda$. Constructive interference is obtained for $D = 1.18 \lambda$ [41]
Fabry-Perot sonic crystal slab resonator

Figure: Amplitude transmission coefficient through (a) 3D and (b) 2D double phononic crystals. Theoretical predictions with and without absorption (solid and dashed lines, respectively) are compared with the experimental data (symbols) [42].
Fabry-Perot silicon phononic crystal slab resonator

Figure: PC slab resonator structure in silicon [43].
Defect cavities in a SQ sonic crystal of steel rods in water

Figure: Full band gap extending from 260 to 312 kHz. $d = 2.5$ mm and $a = 3$ mm. [6]
Linear sonic crystal defect waveguide

Figure: (a) W1 (b) W2. SQ array of steel rods in water, $a = 3$ mm and $d = 2.5$ mm [44].
Bent defect waveguide in a sonic crystal of steel rods in water

**Figure:** SQ array of steel rods in water, $a = 3$ mm and $d = 2.5$ mm. Pressure distribution is shown at a frequency of 275 kHz [44].
Phononic crystal waveguide for SAW in holey silicon

Figure: Time-domain optical pump-probe measurements [45]