POLITECNICO DI MILANO

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DIS – DEPARTMENT OF STRUCTURAL ENGINEERING

Centre for Computational Structural and Materials Mechanics

GMA08

AIMETA
ASSOCIAZIONE ITALIANA
DI MECCANICA TEORICA
ED APPLICATA

THERMOELASTIC DISSIPATION IN MICRO SYSTEMS

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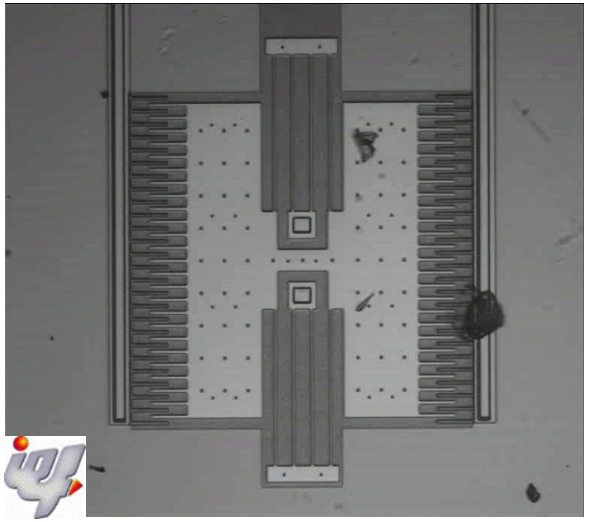
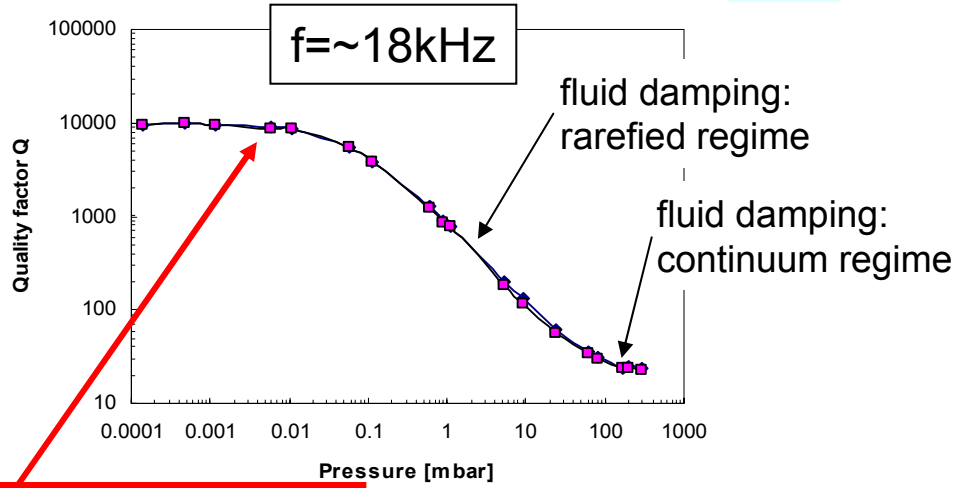
Damping phenomena in MEMS

Example: Tang resonator



Damping "measure": **quality factor Q**

Q^{-1} = fraction of energy lost per radian

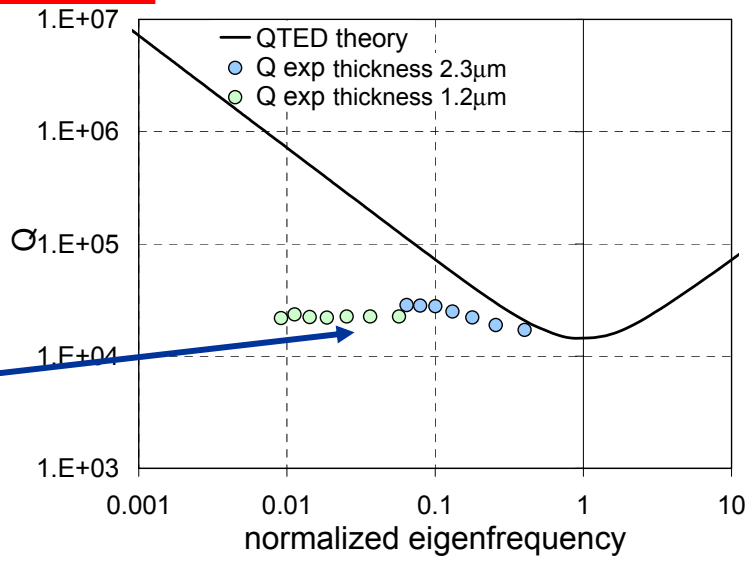


solid/surface damping: internal friction, **thermoelastic dissipation (TED)**

Objectives:

- development of a numerical tool for reliable computation of Q_{TED}
- attempts for explaining experimental results for small scale beams

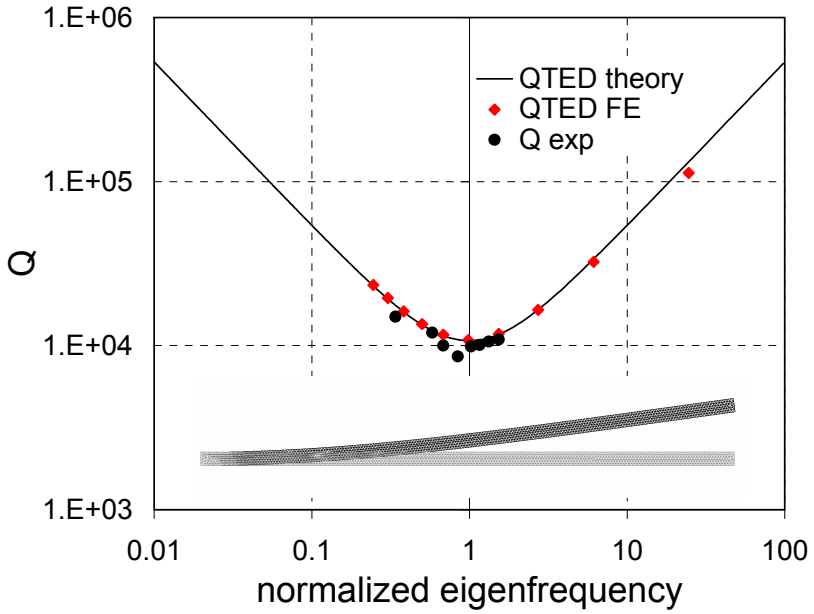
Data from Yasumura et al., JMEMS, 2000.



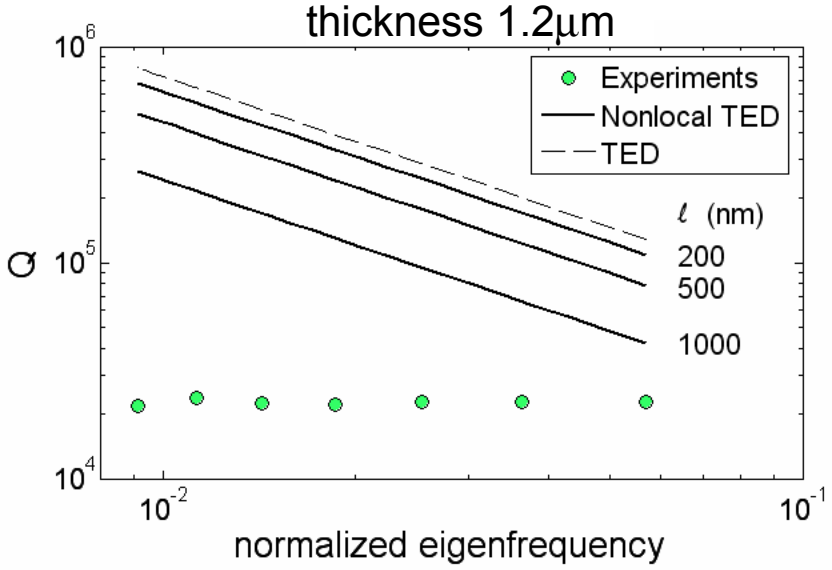
Main results

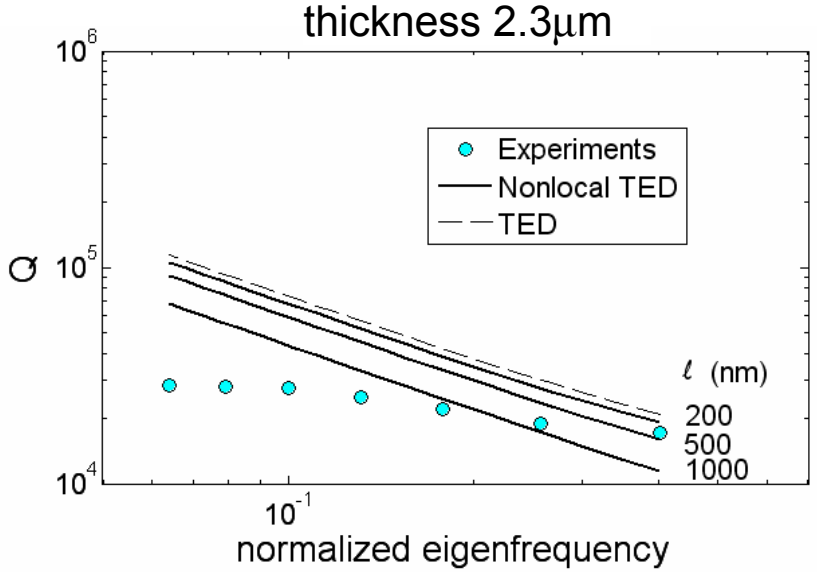
- Q_{TED} computed by FE model and complex eigenvalue analysis: good agreement with experimental and theoretical results for microbeams

Data from Le Foulgoc et al., J. Micromech. Microeng., 2006.



- small scale phenomena interpreted by a non-local thermoelastic model, with internal characteristic length ℓ





Future prospects

- Further developments of the FE code:
  - validation with reference to devices other than microbeams
  - extension to 3D problems
  - implementation of the nonlocal material model

- Future works on dissipation for small scale devices:
  - exploration of different kinds of nonlocal thermoelastic models
  - including dissipation due to "**surface effects**"