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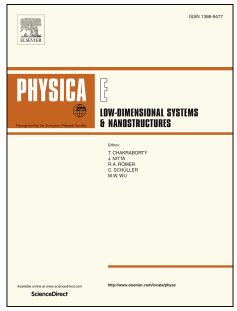

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Flutter instability of cantilevered carbon nanotubes caused by magnetic fluid flow subjected to a longitudinal magnetic field

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Abstract:

CNT (Carbon nanotube)-based fluidic systems hold a great potential for emerging medical applications such as drug delivery for cancer therapy. CNTs can be used to deliver anticancer drugs into a target site under a magnetic field guidance. One of the critical issues in designing such systems is how to avoid the vibration induced by the fluid flow, which is undesirable and may even promote the structural instability. The main objective of the present research is to develop a fluid structure interaction (FSI) model to investigate the flutter instability of a cantilevered CNT induced by a magnetic fluid flow under a longitudinal magnetic field. The CNT is assumed to be embedded in a viscoelastic matrix to consider the effect of biological medium around it. To obtain a dynamical model for the system, the Navier–Stokes theory of magnetic-fluid flow is coupled to the Euler–Bernoulli beam model for CNT. The small size effects of the magnetic fluid and CNT are considered through the small scale parameters including Knudsen number (*Kn*) and the nonlocal parameter. Then, the extended Galerkin's method is applied to solve the FSI governing equations, and to derive the stability diagrams of the system. Results show how the magnetic properties of the fluid flow have an effect on improving the stability of the cantilevered CNT by increasing the flutter velocity.

Keywords: Carbon nanotubes (CNTs); Vibration; magnetic-fluid flow; Small size effects; Fluid structure interaction (FSI).

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