FSM4L_11736

XXI International Congress of Theoretical and Applied Mechanics
Warsaw, Poland, August 15–21, 2004

The Hydroelastic Destabilisation of Finite Compliant Panels

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The destabilisation of finite compliant panels by a uniform mean flow is studied using numerical simulation. Both a generic plate-spring type of wall and a viscoleastic continuum are investigated, respectively modelled using finite-difference and finite-element methods while the flow is modelled using a boundary-element method. The investigation addresses the means by which instability of the whole panel develops from a highly localised applied excitation at flow speeds above that of divergence-onset. A general result emerges. For finite panels two types of convectively unstable divergence waves exist with opposite directions of wall-energy-density propagation. The co-existence of these waves, and their repeated interactions with the panel ends, permits the spread of wall-energy increase to all spatial locations. This globally unstable behaviour and sustained growth with time occurs without the formal existence of absolute instability that is theoretically predicted for much higher flow speeds.

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