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Keynote Lecture

Analysis on vibrations of thin-walled elastic structural elements - Some recent topics

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Abstract. Thin-walled elements, such as beams, arches, plates and shell-panels are widely used in recent downsized and light-weighted machines. Since flat beams and plates have low rigidity, curved elements such as arches and shell-panels are widely used. Rigidity of the curved elements are fairly higher than that of the flat elements, because lateral deflection is coupled to in-plane deflection which enhance the rigidity of the curved structures. Furthermore, when large amplitude vibrations are generated in the flat or curved thin elements due to resonance, the lateral deflection has nonlinear coupling with the in-plane deformation which results in complex nonlinear vibration responses such as, subharmonic resonance, super harmonic response, internal resonance and chaotic vibrations. Recently, shapes of structural elements becomes more and more complex, thus analytical procedures are required to compute vibrations of such complex-shaped elements, precisely considering linear or nonlinear couplings between deflection and in-plane deformation with low computational costs. In this lecture, some recent topics in analysis on vibrations of thin-walled structural elements: (1) nonlinear vibration analysis on beams with variable cross section, (2) linear vibration analysis on rectangular or annular plates dividing finite segments with higher-order-differentiable mode function, and (3) vibration analysis on shell-panels including clamped edges.