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A Proposal of Numerical Method for Dynamic Responses of Complicated Systems and Application to Damped Structures Having Acoustic Black Hole

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Abstract. A fast finite element method is proposed to compute dynamic properties for complicated systems having elastic/viscoelastic/porous structures with acoustic black holes. The acoustic black hole proposed by Krylov is plates having an edge where its thickness decreases sharply as a power function of the thickness. And on the small area of the edge, viscoelastic damping material is laminated. By using this structure, flexural waves cannot be reflected at the edge with the acoustic black holes. We proposed expressions of modal damping by applying asymptotic expansion to complex eigenvalue problem of the dynamics systems. We can analyze modal couplings in damping of the complicated dynamics systems. This method is named as MSKE (Modal Strain and Kinetic Energy) Method. This proposed method can be applied to calculate impact responses of complicated structure including not only elastic/viscoelastic/porous material but also the acoustic black holes. We applied this method to obtain responses for L-shaped damped structures with the acoustic black holes. We also analyzed laminated structures with a porous material sandwiched by two elastic plates having the acoustic black holes.