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Flexural wave propagation in metamaterial beams containing membrane-mass structures

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**Highlights**

- Flexural wave propagation of a metamaterial beam containing membrane-mass structures is investigated.
- A low-frequency resonant-type bandgap where waves cannot propagate freely is created.
- By altering the properties of the membrane-mass structure, the bandgap location can be easily tuned.
- Multiple resonant-type bandgaps can be achieved by using multiple kinds of unit cells.
- An analytical model is introduced for precisely predicting the resonant frequency of the membrane-mass structure.

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