INSTABILITY OF COMPRESSIBLE VISCOELASTIC MODELS

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It is usually assumed that the Maxwell viscoelastic response of Earth models to surface loads with the Heaviside time dependence reaches an isostatic equilibrium after a sufficiently long time. It was analytically shown that it is valid for a homogeneous incompressible sphere. It seems to be not commonly known that it can be analytically shown that it is not valid for a homogeneous compressible sphere. We present the full spectrum of such a model, computed both from the initial-value approach and from the analytical solutions; corresponding unstable response is rising at the time scale of $O(10^4 \text{ yr})$. This feature of instability is kept by any compressible spherical layer with constant parameters, and also by models built up from such layers; thus, the isostatic equilibrium state cannot be reached by a viscoelastic response for layered compressible models. The compressible fluid in the isostatic equilibrium can be stable if density distribution satisfies the Adams-Williamson equation. The response of the compressible sphere with such density distribution is numerically shown to be perfectly stable. Conclusion: viscoelastic responses of compressible models to surface loads are stable only when the density models themselves are stable. Simplified models with few homogeneous layers are inadequate in viscoelastic modelling with finite bulk modulus.

Submittal Information
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5. Oral presentation (slightly) preferred.
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