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Mandel and Cryer Problems For Fluid-Saturated Foams With Negative Poisson's Ratio

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The advent of various foams with negative Poisson's ratio has interested us in how they behave when saturated with fluid. To explore it, we have solved the 2D and 3D problems corresponding to those treated by Mandel and Cryer. The results show that much more remarkable Mandel-Cryer effect and additional unusual phenomena are observed for the negative Poisson's ratio than for the conventional one. In all problems, pore pressure at the sample center has a peak at some time after step-like loading. Similar behaviors are observed in circumferential stress at the sample center. Their peaks are higher for the Cryer problems than for the Mandel ones and for the 3D problems than for the 2D ones. In the Mandel problems, a sample having a negative Poisson's ratio expands laterally immediately after loading, then gradually contracts and finally becomes slenderer than the original in spite of axial compression.

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