

**Hill, A. A.; Straughan, B.**

**A Legendre spectral element method for eigenvalues in hydrodynamic stability.** (English)

Zbl 1092.65065

J. Comput. Appl. Math. 193, No. 1, 363-381 (2006).

Summary: A Legendre polynomial-based spectral technique is developed to be applicable to solving eigenvalue problems which arise in linear and nonlinear stability questions in porous media, and other areas of continuum mechanics. The matrices produced in the corresponding generalised eigenvalue problem are sparse, reducing the computational and storage costs, where the superimposition of boundary conditions is not needed due to the structure of the method. Several eigenvalue problems are solved using both the Legendre polynomial-based and Chebyshev tau techniques. In each example, the Legendre polynomial-based spectral technique converges to the required accuracy utilising less polynomials than the Chebyshev tau method, and with much greater computational efficiency.

**MSC:**

- 65L15 Numerical solution of eigenvalue problems involving ordinary differential equations
- 34L16 Numerical approximation of eigenvalues and of other parts of the spectrum of ordinary differential operators
- 76S05 Flows in porous media; filtration; seepage
- 76E20 Stability and instability of geophysical and astrophysical flows

Cited in **6** Documents

**Keywords:**

spectral methods; porous media; sparse matrices; hydrodynamic stability; generalised eigenvalue problem; numerical examples

**Software:**

ARPACK

**Full Text:** [DOI](#)

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