An efficient adaptive finite element method algorithm with mass conservation for analysis of liquid face seals

液体润滑端面密封质量守恒自适应有限元算法

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- **Research purpose**
  - To propose an effective finite element numerical algorithm to precisely predict the seal performance of mechanical seals by considering the mass conservation.
- **Innovation points**
  - The Streamline Upwind Petrov Galerkin (SUPG) finite element method was used to solve the Reynolds equation with mass conservation.
  - An effective numerical iteration technology was proposed to deal with the complementary problem of the control equation.
  - An adaptive mesh refinement technology was supplied according to the posterior error of the film pressure and film fraction.
- **Conclusions**
  - The SUPG technology eliminates the spurious oscillations of the numerical solution.
  - Adaptive mesh refinement technology can enhance the solution precision.
  - The proposed algorithm is faster than the finite different method (FDM).

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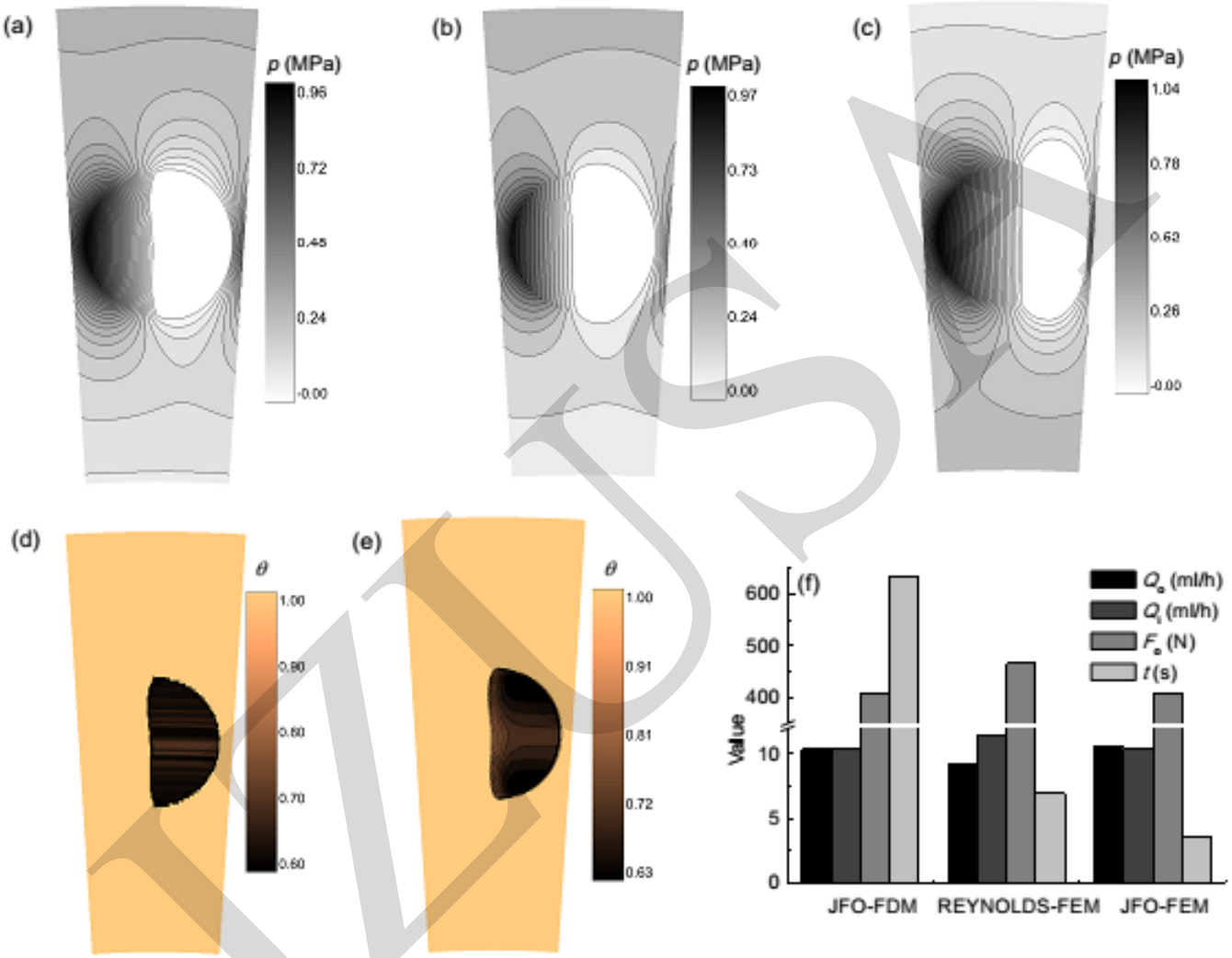

Fig. 1 Numerical results comparison

Pressure distribution of mechanical seal with one dimple by JFO-FEM (a), JFO-FDM (b) and Reynolds-FDM (c), film fraction from JFO-FEM (d) and JFO-FDM (e), and seal performance comparison (f)