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CLOSURE APPROXIMATIONS FOR A SEMIFLEXIBLE FIBER ORIENTATION MODEL IN SUSPENSIONS [1]

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A mesoscale fiber orientation model allowing for flexibility effects has been introduced in [1], see also [2]. The individual fibers are modelled as three beads connected by two rigid rods. The orientation distribution of an ensemble of fibers associated with a representative elementary volume is then a distribution supported on a subset of $S^2 \times S^2$. A Fokker-Planck equation is derived for the orientation distribution function. Due to the prohibitive computational expenses, the model is reduced by a low-order expansion of the solution in bi-spherical harmonics. This procedure leads to a generalization of the Folgar-Tucker model.

Approximation of a solution of Folgar-Tucker equation by truncated series of spherical harmonics leads to a much studied closure approximation problem [2]. The semiflexible fiber model leads to a different closure problem. The article [1] proposes a simple closure relation (polynomial), which, however, is only fitted for highly aligned orientation states. An experimental validation of the model has been reported in [3] showing only qualitative agreement with the experimental results.

In this work we propose closure relations adapted for other orientation states. Specifically, a linear closure relation derived from a regularization approach and a hybrid closure relation, which interpolates between the linear and polynomial closures. Computational examples are presented.

REFERENCES

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