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Quantitative Rheological Model Selection JONATHAN FREUND, RANDY EWOLDT, University of Illinois at Urbana-Champaign — The more parameters in a rheological the better it will reproduce available data, though this does not mean that it is necessarily a better justified model. Good fits are only part of model selection. We employ a Bayesian inference approach that quantifies model suitability by balancing closeness to data against both the number of model parameters and their a priori uncertainty. The penalty depends upon prior-to-calibration expectation of the viable range of values that model parameters might take, which we discuss as an essential aspect of the selection criterion. Models that are physically grounded are usually accompanied by tighter physical constraints on their respective parameters. The analysis reflects a basic principle: models grounded in physics can be expected to enjoy greater generality and perform better away from where they are calibrated. In contrast, purely empirical models can provide comparable fits, but the model selection framework penalizes their a priori uncertainty. We demonstrate the approach by selecting the best-justified number of modes in a Multi-mode Maxwell description of PVA-Borax. We also quantify relative merits of the Maxwell model relative to powerlaw fits and purely empirical fits for PVA-Borax, a viscoelastic liquid, and gluten.

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