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Unexpected Breakup Dynamics of Compound Jets PANKAJ DOSHI, RONALD SURYO, ROBERT COLLINS, MICHAEL HARRIS, OSMAN BASARAN, School of Chemical Engineering, Purdue University, West Lafayette, IN 47907, USA — Understanding the breakup dynamics of a compound or a two-fluid jet is of great importance in applications such as micro-/nano-encapsulation and emulsion formation. Breakup dynamics of compound jets are studied computationally using finite element analysis. For single fluid jets, it has been known for over a century that a jet is unstable (stable) to small amplitude perturbations if the wavelength of the perturbation λ is larger (smaller) than the unperturbed circumference of the jet. Response of compound jets is quite similar to that of single-fluid jets if λ is larger (smaller) than the unperturbed circumference of the outer surface of the jet. However, it is shown that an unexpected oscillatory instability results if λ is larger than the unperturbed circumference of the inner surface of the jet but smaller than that of the outer surface of the jet when the ratio of the interfacial tension of the outer interface to that of the inner interface is much larger than unity. Pressure fields, streamlines, and energies are interrogated to elucidate the physics of the instability.

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