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# 4th Annual Meeting of the APS Division of Fluid Dynamics

Sunday–Tuesday, November 21–23, 2021; Phoenix Convention Center, Phoenix, Arizona

### [Session M27: Particle-laden Flows: Non-Spherical Particles I](#)

1:10 PM–3:07 PM, Monday, November 22, 2021

Room: North 227 ABC

Chair: Kourosh Shoele, Florida State University

Abstract: M27.00009 : Buckling and temporal order of flexible fibers in shear flows\*

2:54 PM–3:07 PM

#### *Authors:*

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#### *Abstract:*

Dynamics of flexible fibers in shear flow are studied experimentally and numerically for initially straight configurations at different 3D orientations with respect to the flow. The Reynolds number is much smaller than unity. We focus on time scales of the order of a few Jeffery periods, and analyze dependence of the dynamics on the ratio  $A$  of bending to shear forces. In the experiments, we observe fibers in the flow-vorticity plane, which gives insight into the motion out of the shear plane. In the simulations, we use the multipole expansion corrected for lubrication and implemented in the precise Hydromultipole numerical codes. We observe that for a very limited range of initial orientations from the compressional region of the shear flow, excluding those from the flow-vorticity plane, fibers undergo a compressional buckling, with a pronounced but very short deformation of shape along their whole length, which is in contrast to the typical local bending that originates over a long time from the fiber ends. Since fibers straighten out in the flow-vorticity plane while tumbling, the compressional buckling is transient -- it does not appear for times longer than  $1/4$  of the Jeffery period. For larger times, bending of fibers is always driven by their ends.

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