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Dynamics of a liquid jet atomized by gaseous crossflow ARIENTI MARCO, GREGORY HAGEN, MAY CORN, MARIOS SOTERIOU, United Technologies Research Center — When captured by high-speed, high-resolution videos, the dynamics of a liquid jet subject to a crossflowing air stream with no external forcing appears to be composed by slow column bending motions and fast traveling surface waves. Sequences of consecutive near field line-of-sight images of the jet acquired for gas Weber numbers between 10 and 300 and momentum flux ratios between 10 and 100 are analyzed with the method of snapshots to decouple this complex liquid interface motion into few fundamental dynamic modes. The exposure time of each snapshot "freezes" the flow, thus providing a sharp liquid interface, while the acquisition rate is comparable to the characteristic time of moderate Weber number surface waves. Spectral decomposition analysis reveals broad-band oscillations that can be linked to the amplification of column waves near the point of column break-up. As the Weber number increases at constant momentum flux ratio, the broad band peak shifts toward higher frequencies until the aliasing limit is reached. As the liquid jet velocity increases, and the column becomes turbulent, a cascade of finer temporal and spatial structures are found with increasing pixel brightness variation intensity that affect similarly small scales of the downstream spray.

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