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Steady-streaming effects on the motion of the cerebrospinal fluid (CSF) in the spinal canal JENNA LAWRENCE, WILFRIED COENEN, ANTONIO SANCHEZ, JUAN LASHERAS, University of California, San Diego — With each heart beat the oscillatory blood supply to the rigid cranial vault produces a time-periodic variation of the intracranial pressure that drives the cerebrospinal fluid (CSF) periodically in and out of the compliant spinal canal. We have recently conducted an analysis of this flow-structure interaction problem taking advantage of the small compliance of the dura membrane bounding externally the CSF and of the disparity of length scales associated with the geometry of the subarachnoid space. We have shown in an idealized geometry that the steady-streaming motion associated with this periodic flow, resulting from the nonlinear cumulative effects of convective acceleration, causes a bulk recirculation of CSF inside the spinal canal, which has been observed in many radiological studies. We extend here our study to investigate the possible contribution arising from the flow around the nerve roots protruding from the spinal cord, an effect that was neglected in our previous work. For this purpose, we consider the oscillatory motion around a cylindrical post confined between two parallel plates. For large values of the relevant Strouhal number we find at leading order a harmonic Stokes flow, whereas steady-streaming effects enter in the first-order corrections, which are computed for realistic values of the Womersley number and of the cylinder height-to-radius ratio.

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