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Undulatory buckling of a rod constrained by an elastic matrix JIA LIU, TIANXIANG SU, Harvard University, OSCAR LOPEZ-PAMIES, UIUC, PEDRO REIS, MIT, KATIA BERTOLDI, Harvard University — Elastic instabilities of rods constrained by an elastic matrix and subjected to axial compression have long been recognized as essential for structural applications in the context of failure mitigation and, more recently, towards exploitation of functionality. Relevant fields for this class of problems include drilling, biomedical instrumentation and root growth in plants. We explore the two possible scenarios observed when, above a threshold load, compression is applied to a rod constrained by a matrix: i) the rod can develop a planar oscillatory solution (sinusoidal buckling) or ii) it can take the configuration of a helix (helical buckling). We identify the principal parameters of this system, perform a systematic parametric study and rationalize the phase diagram through a hybrid of theoretical and numerical analyses. Particular attention is devoted to the effect of the mechanical properties of the constraining matrix which is found to have a critical influence on this buckling scenario.

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