# A computer-assisted existence and multiplicity proof for travelling waves in a nonlinearly supported beam

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For a nonlinear beam equation with exponential nonlinearity, we prove existence of at least 36 travelling wave solutions for the specific wave speed $c = 1.3$. This complements known existence results of *one* solution for *varying* $c$ [1,2,3]. Our proof makes heavy use of computer assistance: Starting from numerical approximations, we use a fixed point argument to prove existence of solutions "close to" the computed approximations.

## References

[1] S. Santra, J. Wei, Homoclinic solutions for fourth order traveling wave equations, *SIAM J. MATH. ANAL.*, **41**, No. 5 (2009), pp. 2038–2056.

[2] D. Smets, J.B. Van den Berg, Homoclinic solutions for Swift-Hohenberg and suspention bridge type equations, *Journal of Differential Equations* **184** (2002), pp. 78–96.

[3] J. B. van den Berg, M. Breden, J.-P. Lessard, and M. Murray, Continuation of homoclinic orbits in the suspension bridge equation: a computer-assisted proof, *Journal of Differential Equations*, **264(5)** (2018), pp. 3086–3130.