A nonlocal biharmonic operator and its connection with the classical bilaplacian

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ABSTRACT

In this work we introduce a nonlocal operator as a natural generalization to the biharmonic operator that appears in plate theory. This operator is built in the nonlocal calculus framework defined in [2] and is connected with the recent theory of peridynamics. For the steady state equation coupled with different boundary conditions we show existence and uniqueness of solutions, as well as regularity of solutions. The boundary conditions considered are nonlocal counterparts of the classical clamped and hinged boundary conditions. For each system we show convergence of the nonlocal solutions to their local equivalents using compactness arguments developed in [1].

REFERENCES

[1] J. Bourgain, H. Brezis, and P. Mironescu. *Another look at Sobolev spaces*. A Volume in Honour of A. Bensoussans 60th Birthday, 439–455 (2001)

[2] Q. Du, M. Gunzburger, R. B. Lehoucq, and K. Zhou. *A nonlocal vector calculus, nonlocal volume-constrained problems, and nonlocal balance laws*. Math. Models and Methods in Applied Sciences, **23** (03), 493–540 (2013).