Chapter 6
Conclusion

In this book, the deformation of Euler–Bernoulli beam has been studied comparatively by utilizing different nonlocal beam theories, including the Eringen's stress-gradient beam equation, the Mindlin's strain-gradient beam equation, the higher-order beam equation and the peridynamic beam equation. All these nonlocal theories introduce one or two nonlocal parameters for the Euler–Bernoulli beam equations. Benchmark examples are solved analytically using these nonlocal beam equations and are compared to their local counterparts, including the simply-supported beam, the clamped–clamped beam and the cantilever beam. Results show that these nonlocal beam equations reduce to the local Euler–Bernoulli equation when the nonlocal parameter goes to zero. For the simply-supported beam and the cantilever beam, the Eringen's stress-gradient beam equation and the peridynamic beam equation yield a much softer beam deformation, while the beam governed by the Mindlin's strain-gradient beam equation is much stiffer. However, the cantilever beam deforms otherwise. Moreover, the Euler–Bernoulli beam governed by the higher-order beam equation can be stiffer or softer depending on the values of the two nonlocal parameters. Furthermore, a fluctuation on the displacement of the truncated-order peridynamic beam equation is observed on the simply-supported and the clamped–clamped beam and is explained from the singularity of the solution expression. Therefore, the deformation of the beam depends on its governing equation as well as its boundary conditions. Finally, the integral-form peridynamic beam equation is solved numerically after constructing certain boundary conditions. This comparative study on nonlocal beam theories intends to impress the readers on the complicated behaviors of Euler-Bernoulli beams and the importance of nonlocal boundary condition treatments.

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