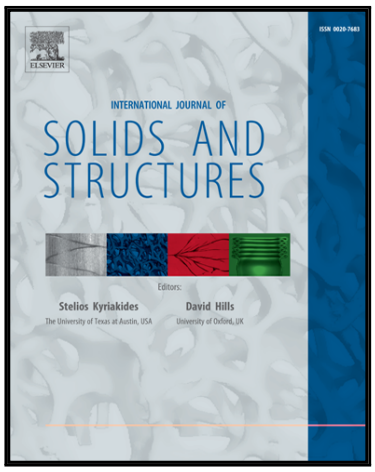


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# An adaptive differential quadrature element method for large deformation contact problems involving curved beams with a finite number of contact points

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**Abstract**

Contact problems involving large deformation of curved beams are difficult to analyze due to uncertainty of contact positions and strong nonlinearity. A nonlinear large-deformation model of curved beams is formulated in arc-length coordinates. A new adaptive differential quadrature element method (ADQEM) is proposed to predict contact positions of a curved beam with a finite number of contact points, where a dragging method and continuity conditions are combined to determine the contact positions. Simulation results show that the ADQEM greatly improves efficiency and accuracy of the large-deformation contact problem of the curved beam. The number of iterations in the present method does not greatly increase with the number of contact points.

**Keywords** curved beam; large deformation; contact points; ADQEM; dragging method

## 1. Introduction

Large-deformation contact of beams is a classical mechanical problem. Recently, with increased demand for studies in civil, aerospace and petroleum engineering, such as drill pipes, the large-deformation contact of beams has become an important topic