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GEOMETRIC NUMERICAL INTEGRATION FOR THE PROCESS OF SPINNING DEPLOYMENT OF THE E-SAIL FLEXIBLE MULTIBODY DYNAMIC SYSTEM

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The Electric sail (E-sail) is a new kind of propulsion system, as shown in Figure 1, which is composed of a set of slender wires initially coiling on reels installed on a hub. In order to assure that each wire deploys completely to the stable tensioning state, the driving hub needs to maintain at a high rev during the process of deployment. In analytical model, the coupling between high rotation and the large flexibility of wire element plays a vital influence on the computational stability and accuracy. Therefore, this paper aims to focus on the long-term stable numerical computation of the spinning E-sail wire using the variable length Absolute Nodal Coordinate Formulation[1], the definition of the beam element is shown in Figure 2. The second order Stormer-Verlet[2] symplectic integration formula is constructed based on the derivation of the non-inertial cable element. According to the simulation, the system energy is investigated to measure the fidelity of the structure preserving algorithm.

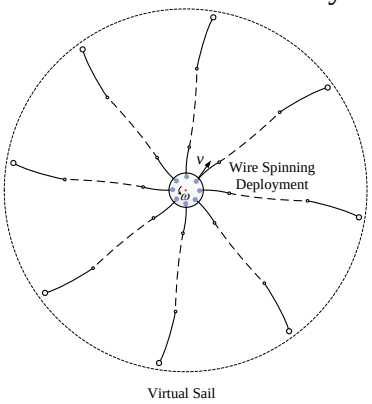

Figure 1: Configuration of the E-sail

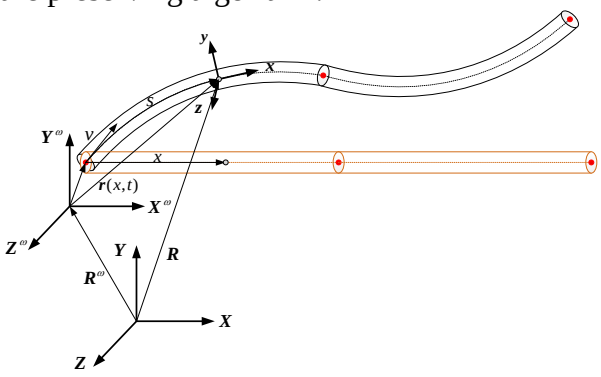

Figure 2: Displacement field of the variable length element under the spinning coordinate system

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