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Currently monopiles are the most common foundation solution for offshore wind turbines. The design of monopiles relies on empirical data from tests performed on long, slender, small-diameter piles loaded predominantly in shear. In contrast, a monopile is a large-diameter, relatively short pile on which load is applied with a large eccentricity. With centrifuge tests as the basis, this paper investigates the behaviour of a rigid pile loaded with a high eccentricity. A test series was carried out to simulate idealized monotonic load cases for monopiles supporting an offshore wind turbine. Centrifuge tests were performed on model monopiles subjected to stress distributions equal to prototype monopiles with pile diameters ranging from 1–5 m and eccentricities ranging from 8.25–17.75 pile diameters. It was possible to identify a unified response of all of these tests by using dimensional analysis and Rankine’s passive earth pressure coefficient as a normalization parameter. The normalized ultimate soil resistance was unaffected by acceleration level and load eccentricity, indicating that the failure mechanism was the same for all tests. Based on the centrifuge tests, a reformulation of soil–pile interaction curves is presented. The normalized initial stiffness of the soil–pile resistance curves was seen to increase linearly with depth in the centrifuge tests. The reformulation differs from current guidelines in terms of the shape of the interaction curve and magnitude of ultimate resistance.

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