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A semi-theoretical analysis for predicting underwater noise radiated from offshore pile driving

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Driving huge tubular piles into seafloor by hydraulic impact hammers radiates strong underwater noise, which may hurt marine mammals. Noise forecast and reduction is necessary to protect underwater animals. A semi-theoretical model is developed for predicting vibration and sound of offshore piling, in which the pile is described as an elastic cylindrical shell. A modified variational methodology is suggested to formulate the vibration of pile, in which the pile is partitioned into several tube segments based on Reissner-Naghdi's shell theory. The exterior and interior sound pressures of pile are expressed as analytical series in frequency domain. The effect of the acoustic fluid on structural vibration is taken into consideration, in which the interface work done by the sound pressure is incorporated into the total variation function. Some dominant factors to determine the exterior radiation noise is investigated, such as interior fluid, dimensions of pile, properties of seabed.

Keywords: Underwater noise, Piling noise, Theoretical analysis, Underwater animal protection