15th INTERNATIONAL CONFERENCE
Dynamical Systems — Theory and Applications
December 2-5, 2019. Lodz, POLAND.

DSTA 2019

paper id: CON59

Innovative tuned resonant devices for offshore floating wind turbines

Valentina Laface, Carlo Ruzzo, Giuseppe Failla, Felice Arena

Abstract: Serviceability of offshore floating wind turbines strongly depends on adequate mitigation of the support motion and, although a few strategies have been proposed in this respect, many challenges are still to be addressed for a consistent reduction of support oscillations under combined wind-wave loadings. The purpose of the paper is to introduce innovative tuned resonant devices for floating wind turbines, consisting of multi-degree-of-freedom (MDOF) mass-spring subsystems with multiple internal resonances tunable to various potential frequencies. This concept is suggested by experimental/numerical evidence that the frequency response of floating supports for wind turbines exhibits distinct peaks, corresponding to structural motion as well as to the main frequency contents of wind and waves. The study will focus on the OC3-Hywind spar as reference floating wind turbine. Different potential MDOF tuned resonant devices will be investigated, with translational degrees of freedom activated by rigid body motions of the spar. Numerical results will be obtained from a simplified non-linear numerical model under variable input conditions, including different wind velocities, periodic and irregular waves. Non-linearity will be associated with fluid-structure interaction, while the rotor-nacelle-assembly will be reverted to a lumped mass loaded by a thrust force in operational and parked rotor conditions. The simplified numerical model will provide preliminary yet valuable insight into the performances of the proposed MDOF tuned resonant devices.

---

[1] Valentina Laface, Ph.D.: University of Reggio Calabria, Via Graziella, 89124 Reggio Calabria, Italy (IT), valentina.laface@unirc.it, the author presented this contribution at the conference in the special session: "Innovative strategies for vibration control and mitigation" organized by G. Failla and R. Santoro.

[2] Carlo Ruzzo, Ph.D.: University of Reggio Calabria, Via Graziella, 89124 Reggio Calabria, Italy (IT), carlo.ruzzo@unirc.it.

[3] Giuseppe Failla, Associate Professor: University of Reggio Calabria, Via Graziella, 89124 Reggio Calabria, Italy (IT), giuseppe.failla@unirc.it.

[4] Felice Arena, Professor: University of Reggio Calabria, Via Graziella, 89124 Reggio Calabria, Italy (IT), arena@unirc.it.