

5th World Congress on

SMART AND EMERGING MATERIALS

April 19-20, 2018 Dubai, UAE

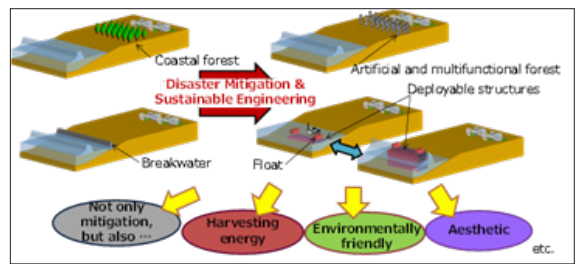


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Novel applications of smart materials and structures aiming at disaster mitigation

The purpose of this study is to use novel materials/technologies such as smart materials/structures and related technologies to enable revolutionary prevention/mitigation of disasters. To realize this idea, the deployable breakwater shown in Figure was proposed by the author as an example, which can be used daily for energy harvesting, small enough not to become an obstacle, and a smart breakwater deployable by force and material of tsunami etc) The author discussed new approaches which enable sustainability as well as disaster mitigation, and named it “Disaster Mitigation and Sustainable Engineering.” In



In this study, smart disaster mitigation strategies especially based on the new approaches are described. To demonstrate a part of the concept, two basic experimental researches, i.e. artificial forest and novel deployable structure based on honeycomb are examined. The artificial forest was examined to have better capability of high wave or tsunami mitigation by changing various parameters such as configuration, density and material. Multifunctional design was also mentioned. The novel deployable structure based on honeycomb to be used against flooding etc. was demonstrated to be autonomously deployable due to increase of water level as external environmental change. This autonomously height-controlled river or anti-flooding bank system can be regarded as a smart structure. The researches below are also undergoing by the author and/or his collaborators. (i) Applications of piezoelectric polymers in electrical power generation using ocean waves (Su). (ii) Dynamic deployment of smart inflatable tsunami airbags (Shahinpoor).2) (iii) A novel underwater inflatable structures for smart costal disaster mitigation (Adachi). (iv) SHM of pipelines for environment pollution mitigation (Felli et al.).3) (v) Smart disaster mitigation in Italy (Felli et al.).4) (vi) Smart disaster mitigation in Thailand (Aimmanee et al.).5) In addition, Kubo, Tanaka, Maruyama and Asanuma started to develop a multi-layered deployable structural material system to dissipate wave energy by separating water flow and letting them collide. Challenges have been also done in industries. Especially, neo RiSe flap-gate type seawall (Hitachi Zosen), SHEL CAR (STARLITE Co., Ltd.), MOSE Project and Aqua Dam are attractive. Takenaka Corporation proposed innovative “Breakwater and breakwater group.” In conclusion, the novel concept was successfully demonstrated as the first step in this study and it has to be brushed up to smartly overcome or rather utilize disasters toward future.

References

1. Felli F, et al. (2015) Structural health monitoring of pipelines for environment pollution mitigation. Proc. ASME SMASIS2015, Paper No. 2015-8922: 1-7.
2. Felli F, et al. (2014) Smart disaster mitigation in Italy, Proc. ASME SMASIS2014, Paper No. 2014-7631, 1-8.
3. Aimmanee S, et al. (2016), Smart disaster mitigation in Thailand, Proc. SPIE Vol. 9803, Paper No. 98030W-1: 1-7.

Recent Publications

1. Asanuma H, et al. (2016) Disaster mitigation based on smart structures/materials. SPIE Vol. 9803, Paper No. 980302-1: 1-12.
2. Shahinpoor M, Asanuma H (2015) Dynamic deployment of smart inflatable tsunami airbags (TABS) for tsunami disaster mitigation. Proc. ASME SMASIS2015, Paper No. 2015-8904: 1-4.

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Biography

Hiroshi Asanuma has been developing the field of smart materials/structures and related technologies for many years by proposing new concepts and demonstrating them, which include such as metal-based smart composites (fiber reinforced metals capable of fiber-matrix sliding for secondary forming, healing, etc., optical fiber embedded aluminum etc. as structural materials having robust sensing function, metal-core piezoelectric fiber embedded aluminum etc. as structural materials having robust sensing/actuating/energy harvesting functions, active laminates having variety of functions such as actuating/sensing/repairing, and so on. After the serious earthquake and tsunami disasters in Japan in 2011, he started to apply smart materials/structures including his variety of robust materials, and has proposed the novel concept of "Disaster Mitigation and Sustainable Engineering" with his colleagues, which intends to enable sustainability as well as disaster mitigation, effectively and economically. He has developed a research committee, organized workshops/conference sessions, delivered plenary/keynote/invited presentations and seminars to establish the new world.

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