A consideration of underwater shock wave behavior at interface for various acoustic impedance materials using the computational prediction

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Recently, the methodology and technology of food treatment using underwater shock wave has been attracting attentions as a novel processing. The shock wave targeted in our research is a pulse wave of a momentary and high-pressure power. The pulse wave propagates in a medium such as water, air, food and faster than the speed of sound. The shock wave induced by the underwater electrical wire explosion can generate the momentary extremely high pressure power, and achieve no-heating/no-destruction associated with a flavor and nutritive value as process in microsecond timescale. Therefore, it is very expected as a novel food processing technology. An example of pre-processing meat, vegetable, food sterilization, oil extraction and rice powder manufacturing system have been experimentally reported in the past. Regarding the development of the corresponding food processing equipment, suitable devices must be designed to satisfy various conditions. Their design is extremely difficult to investigate experimentally, because there are so many parameters to consider in ensuring suitable food processing, and the shock wave propagation phenomenon ends in a very short time. Thus, it is very helpful for a computational simulation to be performed to investigate shock wave propagation in the proposed food processing vessel. Therefore, in this paper, to reveal shock wave propagation characteristics in foods, computational models of the food, the surrounding water, and the high-pressure source were developed using the commercial finite element software. By conducting a series of numerical simulations, the pressure distribution in various foods associated with their acoustic impedances has been discussed.

Biography

Yoshikazu Higa has done his Bachelor's and Master's Degree in Mechanical Engineering at University of Ryukyus and then he persuaded his Doctor of Engineering in Mechanical Engineering at Kobe University and was a Research Associate at Osaka University. He later became Lecturer at Osaka University and worked as an Associate Professor in Mechanical Systems Engineering at National Institute of Technology, Okinawa College. Then he became Professor and currently holds that position. He is currently a member of The Japan Society of Mechanical Engineers (JSME) and The Society of Materials Science, Japan (JSMS). He also serves as a Committee Member of international/domestic conferences and symposiums. His research fields are the theoretical and computational crystal plasticity and computational multiphysics. He is currently working on 80 papers dealing with experimental study and computational simulation of multiphysics phenomena. He has received the JSME Hatakeyama Prize in 1995, and the Best Paper Award in ESIT2016 conference in 2016.

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