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# Improvement of gas medium triaxial apparatus derived from thermal fluid analysis

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A huge amount of effort has used to be required for trial productions during the development of experimental apparatus. Since such trial productions generally consume vast time period and cost, the reduction of them is now a significant issue. Numerical modeling such as the finite element simulation (FE) is widely used to reduce them in various engineering fields.

Gas medium triaxial apparatus is widely used to determine the mechanical properties of rocks precisely at higher temperature. However, there has been a limitation for the use at the higher temperature in Japan due to the thermal design. In this presentation we plan to improve the gas-medium triaxial appratus derived from thermal fluid analysis based on the finite element simulation.

Here, the governing equations for thermal fluid analysis consist of the heat conduction equation, the Navier-Stokes equation and the equation of state. By solving those equations simultaneously, we obtain important physical quantities such as temperature distribution, fluid velocity field, delay of heating, etc. The knowledge derived from the computer simulations are: (1) The argon gas flow hardly has any relation with the temperature distribution on solid materials. (2) The temperatures of adiabatic materials placed near the heat sources are below the maximum operating temperature. (3)A large thermal gradient is observed close to the plastic O-ring.

Based on above results, we have attained valuable improvement policies such as replacement of meterials, improvement of radiation factor on the copper jig, etc.

Keywords: heat, fluid, Navier-Stokes, equation of state, gas medium triaxial apparatus