Qeios

Peer Review

Review of: "Dynamic Equations of the Discrete Particle and Incompressible Continuous Medium (Field) for Generalized Coordinates System"

Dumitru Baleanu[1]

1. Lebanese American University, Lebanon

The abstract of the manuscript is very long, namely

“Using the metric tensor to de ne the in nitesimal displacement vector and the kinetic energy, a generalized scalar function (Lagrangian) is given. It is inherently invariant under a change of coordinates. With this scalar function and the Euler-Lagrangian procedure for a conservative system, a generalized dynamic equation of motion in covariant vector form is derived: for the discrete particle model and for the continuous ow eld model. The covariant acceleration vector is explicitly given. A great advantage of this expression is that it is easy to nd the conservation law in the system and easy to re ect underlying geometric symmetries if the metric tensor is independent of a speci c coordinate direction; an example of the spherical coordinate is shown in the paper. The metric tensor of the spherical coordinate is independent of the azimuthal (ϕ) coordinate. For the discrete particle model, the momentum exchanges between neighboring particles (forces due to the direct interactions between the particle and its neighbors) do not need to be considered; thereby, the kinetic energy is assumed to be independent of the coordinates to neglect the in uence of neighboring particles. The velocity gradient (to be exact, the gradient of kinetic energy) is ignored. The equation degenerates to Newton’s second law for discrete particles, which can be located in a potential eld. For a continuous ow eld, the partial derivatives of the velocity with respect to the coordinates are included (the gradient of kinetic energy), so that the momentum exchanges between the particle and its neighbors are included (interactions between neighboring particles cause changes in kinetic energy and momentum). The kinetic energy gradient forms a product of a velocity gradient and velocity itself. This velocity gradient tensor can be

doi.org/10.32388/6MB1ZQ

decomposed into a symmetric part and an antisymmetric part to separate the local stretching or shrinking deformation (symmetric strain rate tensor) from the uid parcel's local rotation (antisymmetric). There is a ne difference between this model and the Navier Stokes equations. The Navier-Stokes equations consider the momentum exchanges between uid layers using a symmetric viscous stress tensor modeling, while this model is more general and adds an extra local rotational motion term to consider the interaction between velocity and vorticity, exactly to say, adding a half of the cross product of the velocity and vorticity vectors. This analysis primarily relies on a pure theoretical framework without direct validation against experimental data; further work should be conducted for ne experimental validations to support the theoretical ndings. It should be emphasized that this model is only valid for a conservative system, namely without considering the irreversible process, such as viscous dissipations. "

and it should be reduced. The part in the abstract regarding the general aspects should be deleted. The original contributions should be mentioned more clearly. The reference list should be improved too. The quality of the figures should be improved. The conclusion part should be enlarged. Some typos should be corrected, and the general presentation should be improved. The manuscript needs a minor revision.

Declarations

Potential competing interests: No potential competing interests to declare.

doi.org/10.32388/6MB1ZQ