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Date: Nov 15, 2014
To: "Jean C Ragusa" jean.ragusa@tamu.edu,jean.ragusa@gmail.com
cc: torosemail@gmail.com;toro@ing.unitn.it
From: Pierre Sagaut pierre.sagaut@univ-amu.fr
Subject: Your Submission

Ms. Ref. No.: CAF-D-14-00634
Title: Entropy-based viscous regularization for the multi-dimensional Euler equations in low-Mach and transonic flows
Computers and Fluids

Dear Dr. Jean C Ragusa,

Your paper entitled "Entropy-based viscous regularization for the multi-dimensional Euler equations in low-Mach and transonic flows" will be accepted for publication in Computers and Fluids if the enclosed comments of the reviewers are addressed in a revised manuscript. Please respond to the specific comments of the evaluators in a separate document.

However, if you feel that you can suitably address the reviewers' comments (included below), I invite you to revise and resubmit your manuscript. It would be appreciated if you could submit your revised paper by Jan 14, 2015. If additional time is needed to complete the revision I would be most grateful if you would let me know.

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a) outline each change made (point by point) as raised in the reviewer comments

AND/OR

b) provide a suitable rebuttal to each reviewer comment not addressed

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I look forward to receiving your revised manuscript.

Sincerely,

Pierre Sagaut
Editor-in-Chief
Computers and Fluids

Reviewers' comments:

Reviewer #1: The authors have taken all my comments seriously into account. The revised paper can now be published in Computers & Fluids.

Reviewer #2: The paper focuses on the FEM solution of the Euler equations using for stabilization the entropy viscosity method (EVM). The main goal is to derive expressions of the entropy viscosity scaling parameters that can be used in all Mach number regimes, from supersonic flows to incompressible ones. Rather than considering the entropy residual to set up the entropy viscosity, the authors propose to consider a quantity closely related to this residual, but that only depends on the flow variables (pressure and density). On this basis, they carry out an asymptotic study with respect to the Mach number to derive expressions of the relevant scaling of the transport coefficients. It turns out that it is the dynamic viscosity scaling that must be smoothly change, to go from high Mach number flows to low Mach number ones. Several one-dimensional and two-dimensional examples are used to validate the approach. The paper makes use of very recent works, e.g. the regularization of the Euler equations recently introduced by Guermond and Popov (SIAM J. Appl. Math., 2014), and proposes new advances of interest. My remarks are the following:

1) Citations: I think there is a problem with the bibliography. All citations are relevant, but often not used at the right place... This should be checked carefully.
2) lines 160-163: To justify the study of the low Mach regime, the authors postulate that since the residual of the entropy equation is small (the solution being smooth) then the variations of the entropy with respect to its mean value is also small, so that the denominator in (6a) vanishes. This should be discussed.
3) lines 185-188: In eq. (9), it is assumed that tilde R and the entropy residual R vary similarly. It would be nice to go into the details, by explaining, e.g. on the basis of the perfect gas law, how behaves the multiplicative coefficient in (9).
5) The definition of the entropy viscosity is rather complex, since not only based on the entropy residual as in the native form of the EVM but also on the "inter-element jump" and so, in the formulation (10) proposed by the authors, on two of these jumps, for the pressure and the density. On the basis of the numerical experiments, it would be of interest to know which of the 3 terms in the numerator of (10) is really active. Moreover, rather than essentially repeating in (10b) the eq. (10a), it would be clearer to use the viscosity coefficient in the definition of the diffusion coefficient.
6) lines 475-476: The fact that the first order viscosity (FOV) does not give the correct solution is associated

to a scaling problem of the dissipative terms. However, the scaling proposed in the paper only acts on the the viscosity associated to the entropy residual and not on its first order upper bound, which is assumed correct by the authors. This should be discussed.
7) section 6.6: in this example I understand that one focuses on the steady solution. What are then the fluctuations defined in eq. 40 and shown in the graph of Fig. 7 ?
8) lines 501-503: if the shock is correctly resolved it is also because a huge number of grid-points is used (1600 elements). The features of the EVM solution would be better pointed out by using much less grid-points.
9) the text should be checked carefully, e.g. line 33, lines 78-80 (use of specific), line 137 (definition of d_n), eq. 7, eq. 37, line 330, line 704, line 740 etc...
10) The graphs are often not clear, see e.g. Fig. 2a, 2d, 3b, 4 etc...