

Posudek práce

předložené na Matematicko-fyzikální fakultě
Univerzity Karlovy v Praze

- posudek vedoucího x posudek oponenta
 bakalářské práce diplomové práce

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Název práce: Generation of vorticity in velocity field by entropy gradient

Studijní program a obor: Physics

Rok odevzdání: 2012

Jméno a tituly vedoucího/opponenta: Miroslav Grmela

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Odborná úroveň práce:

- vynikající x velmi dobrá průměrná podprůměrná nevyhovující

Věcné chyby:

- téměř žádné x vzhledem k rozsahu přiměřený počet méně podstatné četné závažné

Výsledky:

- originální původní i převzaté netriviální kompilace citované z literatury opsané

Rozsah práce:

- veliký x standardní dostatečný nedostatečný

Grafická, jazyková a formální úroveň:

- vynikající velmi dobrá x průměrná podprůměrná nevyhovující

Tiskové chyby:

- téměř žádné x vzhledem k rozsahu a tématu přiměřený počet četné

Celková úroveň práce:

- vynikající x velmi dobrá průměrná podprůměrná nevyhovující

Slovní vyjádření, komentáře a připomínky vedoucího/oponenta:

Prilozeny dokument

Případné otázky při obhajobě a náměty do diskuze:

Práci

doporučuji

nedoporučuji

uznat jako diplomovou/bakalářskou.

Navrhuji hodnocení stupněm:

výborně velmi dobře dobře neprospěl/a

Ted velmi dobre ale v patricne pozmmenene formne (navrhnete v prilozenem dokumentu) vyborne

Místo, datum a podpis oponenta:

Montreal, 29 srpna 2012-08-29

Miroslav Grmela

Martin Novak, Master Thesis, Charles University, Prague

The aim of the Thesis is to address vorticity generation by entropy gradient (Chapter 6 - 3pages). This is a very interesting problem. I understand it as follows. The momentum balance equation (e.g. the first equation appearing in Chapter 6) relates vorticity to the entropy gradient (provided the terms involving the time derivative, the enthalpy gradient, and the external force are missing). How can one generate the entropy gradient (beside by the dissipative processes)? As the example discussed in Chapter 6 of the Thesis suggests, it can be done by considering a fluid with an internal structure (in the example it is the presence of the second component, namely the water vapor) that can change during the flow (in the example the vapor can change into liquid). Since the entropy depends on the internal structure, creating a gradient in the internal structure implies creating a gradient in the entropy. It may be of interest to consider examples with another internal structure. For instance we can consider a fluid in which polymer macromolecules are suspended. The internal structure in this case is the conformation of the macromolecules. During the flow the macromolecules change their conformation and thus an entropy gradient is created. It is well known that a drag reduction is observed in polymer solutions. This may be, from the physical point of view, the same effect as the drag enhancement expected to be observed in the arrangement suggested in Chapter 6.

In addition to Chapter 6 (3 pages) the Thesis includes (about 40 pages) of a review whose objective is to introduce necessary concepts.

Below, I will note some shortcomings of the Thesis.

1.

The review is, of course, incomplete but, more importantly, not directed toward the main objective (i.e. Chapter 6). For instance, I would expect the author to devote more attention to the concept of entropy and its time evolution (instead, we see e.g. $s = s(T, \dots)$ on page 20).

2.

Particularly bad written is Chapter 7 (Conclusion). Not only the English is very poor (including the spelling mistakes as fenomenologic instead of phenomenological) but it also includes the concepts s_{diss} and s_{eq} that do not appear in the Thesis on another place (at least I cannot find them). Moreover, I would recall that the entropy is a scalar and real valued function of state variables; during the time evolution it either grows (due to time irreversible dissipative

processes) or remains unchange (if the time evolution is reversible and nondissipative). One can speak about dissipative change of the entropy but not about dissipative entropy. I would strongly suggest the author to rewrite Chapter 7.

3.

The review of Continuum mechanics should be more directed to the main objective (the title of the Thesis).

4.

The English should be improved. Moreover, some references are incomplete (e.g.[Bat29] - there is title of the Journal).

In summary. the author demonstrates its competence and mastery of the subject. *I recommend to accept the Thesis as a Master Thesis.* I also however recommend some modifications mentioned above.

Montreal, August 29, 2012

Miroslav Grmela
Professor
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