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LETTER TO THE EDITOR

# Reply to comments on 'Forced convection with slip-flow in a channel or duct occupied by a hyper-porous medium saturated by a rarefied gas'

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We thank the authors of Al-Nimr and Haddad (2006) for their comments on Nield and Kuznetsov (2006). We respond as follows.

1. Al-Nimr and Haddad imply that we have been negligent in our citation of the literature on the subject of our paper. They point to the five papers by Haddad et al. (2005, 2006a,b,c) and Tang et al. (2005). The first of these papers was published in issue 7 of volume 18 of *Numerical Heat Transfer-Part A*, which has a publication date October 15, 2005. The fifth paper was published in issue 5 of volume 72 of *Physical Review E*, which has a publication date November, 2005. The other three papers were still in press at the time of writing. Our paper was accepted in final form on 19 August 2005, before any of these five papers were published.
2. It is true that we have not considered compressibility effects. We have treated forced convection, not natural convection, and we expect that in most practical situations the Mach number for a flow in a porous medium will be small compared with unity, and hence compressibility effects will be negligible.
3. We would argue that any variation in the value of the coefficients in the basic governing equations is a refinement that can appropriately be ignored in a pioneering paper.
4. We were careful to specify that for our analysis we were considering a hyperporous medium and the case of large Darcy number. Indeed, our results show that it is only when the Darcy number is large that the velocity slip has a significant effect on the value of the Nusselt number. In the situation that we investigated the pore length scale is not dramatically different from the macroscopic length scale. The precise value of the Knudsen number (and hence the way in which that number

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is defined) is not critical for our analysis. The important thing is whether it has a value for which it is plausible to employ a continuum model with velocity slip.

5. This is an interesting comment.
6. For the situation that we are modeling, in which we have a temperature boundary condition (our Equ. (6)) of precisely the same mathematical form as the velocity boundary condition (our Equ. (15)), we believe that "temperature slip" is the appropriate term to use in conjunction with "velocity slip".
7. We look forward with interest to the appearance of the various papers by Haddad et al. (2006a,b,c). We see their work as something in parallel with our own work.

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