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# Unsteady mixed flows in non uniform closed water pipes: a Full Kinetic Appraoch

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We recall the \PFS} model constructed for the modeling of unsteady mixed flows in closed water pipes where transition points between the free surface and pressurized flow are treated as a free boundary associated to a discontinuity of the gradient of pressure. Then we present a numerical kinetic scheme for the computations of unsteady mixed flows in closed water pipes. This kinetic method that we call FKA for "Full Kinetic Approach" is an easy and mathematically elegant way to deal with multiple transition points when the changes of state between free surface and pressurized flow occur. We use two approaches namely the "ghost waves approach" and the "Full Kinetic Approach" to treat these transition points. We show that this kinetic numerical scheme has the following properties: it is wet area conservative, under a CFL condition it preserves the wet area positive, it treats "naturally" the drying and flooding area and most of all it preserves every stationary flow. Finally numerical experiment versus laboratory experiment is presented and the scheme produces results that are in a very good agreement. We also present a numerical experiment when flooding and drying flows may occur and finally make a numerical study of the order of the kinetic method.

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