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Handling of congestion in crowd motion modeling

We propose a general framework to incorporate congestion in the modeling of crowd motion in evacuation situations. This approach can be seen as a first order (in time) counterpart of the evolution problem associated to the collective motion of rigid spheres (or discs) with a non elastic collision law. In its simpler, microscopic, form (see [4]), the approach we propose is based on the definition of a desired velocity (corresponding to the velocity one would have in the absence of others); the actual velocity is then defined as the projection of this desired velocity onto the set of feasible velocities (velocity which do not violate the non-overlapping constraints between individuals). This model fits into the general framework of sweeping processes by convex sets [5], and its generalization to non-convex sets [1]. Well-posedness results rely on a so called *catching up algorithm*, which follows a prediction-correction strategy, where the correction consists in projecting a configuration which violates the constraints onto the set of feasible configurations.

We proposed recently a macroscopic version of this approach ([2]): the crowd is described by a density which is subject to remain below a maximal value (congestion). We shall present how the general framework of optimal transportation endows the space of densities with a natural distance (Wasserstein distance) which makes it possible to generalize the catching up approach to this non-Hilbertian setting [3].

We shall address the links and deep differences between micro and macro approaches, from both mathematical and modeling standpoints.

References

[1] J.F. Edmond, L. Thibault, *BV solutions of nonconvex sweeping process differential inclusion with perturbation*, J. Differential Equations 226(1) (2006) 135–179.

[2] B. Maury, A. Roudneff-Chupin, F. Santambrogio, *A macroscopic Crowd Motion Model of the gradient-flow type*, Mathematical Models and Methods in Applied Sciences Vol. 20, No. 10 (2010) 1787-1821.

[3] B. Maury, A. Roudneff-Chupin, F. Santambrogio, J. Venel, *Handling Congestion in Crowd Motion Modeling*, submitted (arXiv:1101.4102v1).

[4] B. Maury, J. Venel, *A discrete Contact Model for crowd Motion*, accepted in M2AN, 2010 (hal-00350815).

[5] J.J. Moreau, *Evolution problem associated with a moving convex set in a Hilbert space*, J. Differential Equations 26(3) (1977) 346?374.