

Urban Air Quality Modelling using Finite Elements

Albert Oliver¹, Eduardo Rodríguez¹, Gustavo Montero¹, Rafael Montenegro¹

¹ Instituto Universitario SIANI, Universidad de Las Palmas de Gran Canaria (ULPGC),
Campus Univ. de Tafira, 35017 Las Palmas de Gran Canaria, España.

E-mail: albert.oliver,eduardo.rodriguez,gustavo.montero,rafael.montenegro@ulpgc.es.

Web page: <http://www.dca.iusiani.ulpgc.es/proyecto2015-2017>

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Urban air quality simulation requires models with different characteristics to those used in mesoscale or microscale. The spatial discretisation resolution is one of them. Urban geometries require smaller elements than those in other scales. Mesh for this kind of geometries are generated using the Meccano method; a mesh generator that has generated high-quality meshes of complex geometries [1]. In this work, we have added capabilities to insert buildings into the mesh maintaining the element quality. Wind field should also be suitable for urban scale. To this end, we will use a mass-consistent model [2]. This approximation has performed efficiently in microscale problems, coupling with mesoscale numerical weather prediction models. Finally, an adaptive finite element method is used to simulate the convection-diffusion-reaction equation [3, 4]. The problem can be convection dominant, so it is stabilised using a Least-Squares finite element method. The resulting matrix is symmetric and is solved using the Conjugate Gradient method preconditioned with an incomplete Cholesky factorisation. The model is applied to the city of Las Palmas de Gran Canaria.

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