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ADJOINT FRAMEWORK AND DIGITAL TWIN FOR SMART PLACEMENT OF DEPOLLUTING PANELS IN URBAN AREAS

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According to WHO, outdoor air pollution causes about 4.2 millions deaths per year in the world. To tackle the problem of air pollution from traffic, depolluting panels based on ZnO photocatalysis [1] can be locally deployed in urban areas. Herein, we propose a virtual testing approach for the optimal placement of depolluting panels at the district scale. It is inspired by previous research works on the optimal placement of gas sensors [2]. Firstly, the district digital twin is used in computational fluid dynamics simulations to perform fine cartographies of the air flow and the concentration pollutants. These simulations allow the identification of critical areas where people can be exposed to high level of pollutant. Then, the pollutant concentration in the determined critical area is defined as a "quantity of interest" and the associated adjoint advection-diffusion-reaction problem is solved. Relevant positions of depolluting panels are obtained by post-processing the adjoint concentration field. In the presentation, the numerical strategy will be illustrated on a real small district in the equipment "Sense-City" [3]. First results show a good agreement between the measured and the simulated turbulent air flow [4]. In incoming works, gas dispersion tests are to be conducted in Sense-City to validate the prediction of the pollutant concentration map and to verify the efficiency of the depolluting panels whose position was determined from the proposed virtual testing approach.

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