Discovering Hidden Controlling Parameters using Data Analytics and Dimensional Analysis[1] ZACHARY DEL ROSARIO, Stanford University, MINYONG LEE[2], Airbnb, GIANLUCA IACCARINO, Stanford University — Dimensional Analysis is a powerful tool, one which takes a priori information and produces important simplifications. However, if this a priori information – the list of relevant parameters – is missing a relevant quantity, then the conclusions from Dimensional Analysis will be incorrect. In this work, we present novel conclusions in Dimensional Analysis, which provide a means to detect this failure mode of missing or hidden parameters. These results are based on a restated form of the Buckingham Pi theorem that reveals a ridge function structure underlying all dimensionless physical laws. We leverage this structure by constructing a hypothesis test based on sufficient dimension reduction, allowing for an experimental data-driven detection of hidden parameters. Both theory and examples will be presented, using classical turbulent pipe flow as the working example. Keywords: experimental techniques, dimensional analysis, lurking variables, hidden parameters, buckingham pi, data analysis

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