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# Developing Acoustic Emission Technique to Characterize Particles in Solid-Gas Flows

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## Extended Abstract

The characterization of particle in solid-gas flow is of great importance in many industrial sectors such as nuclear energy, and pharmaceutical industries. Acoustic techniques can provide a complementary information to other techniques e.g., optical sensors, x-ray, MRI, and acoustic techniques are relatively cheap, can be applied non-intrusively, multi-point measurements are also possible [1,2].

In this work a theoretical model is proposed which describes the collision of particles with reactor wall, and the generation of acoustic emission AE signal in solid-gas fluidized bed. The particle wall impact is modelled based on the Hertz Impact theory [3, 4]. The AE signal post processing and inversion algorithm are introduced to analyse particle size distribution and particle velocity profile. The experimental setups, measurement method and signal processing of acoustic emission AE signal for obtaining particle size, particle velocity in solid-gas fluidized bed are discussed. The experiments were conducted in a vertical tube with a 14 cm inner diameter, made of borosilicate glass, and it contains 2 kg glass particles with density of 2500 kg/m$^3$. The AE signals were measured experimentally for different particle sizes ranging from 100 μm to 1 mm. The measurement technique is based on the measurement of signal frequency, energy, root mean square (RMS) of the generated acoustic emission signal in solid-gas fluidized bed. The experimental data is then used with the theoretical model to form an inverse problem for the measurement of particle velocity and particle size in solid-gas flows. The results indicated that the acoustic emission features, Root mean square RMS, energy of the AE's are related to the change in gas superficial velocity and particle size, and frequency of the generated AE signal is related to the particle size. The result is also shows that the sensor mounted in all locations were able to respond to the change in flow parameters. This study indicated that the AE features have great potential in the application of gas-solid flows.

## References

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