# On the equivalent stiffness in cryogenic tensile testing: FEM–DIC coupled identification approach

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Material testing at low temperatures is typically conducted in accordance with established standards and procedures [1]. However, the mechanical compliance of the testing system remains insufficiently quantified. In particular, the stiffness of the testing machine and the overall experimental set-up can significantly affect the measured response. This influence becomes especially pronounced under discontinuous plastic flow instability (DPF), where the dynamic interaction between the specimen and the extensometer plays a critical role [2].

In this study, the equivalent stiffness of a cryogenic material testing setup (Fig. 1) is determined using a multi-approach methodology. The stiffness is evaluated through analytical formulations, finite element modelling (FEM), and experimental measurements based on Digital Image Correlation (DIC). The developed approaches are compared and validated to ensure consistency and reliability of the obtained results.

Subsequently, the identified equivalent stiffness is incorporated into the analysis of tensile tests to assess its influence on the dynamic response of the specimen–extensometer system and on its impact of material characterization. The obtained results indicate that the extensometer geometry significantly influences the measured response, highlighting the importance of its appropriate selection. Alternatively, this effect can be mitigated by increasing the overall stiffness of the testing system.

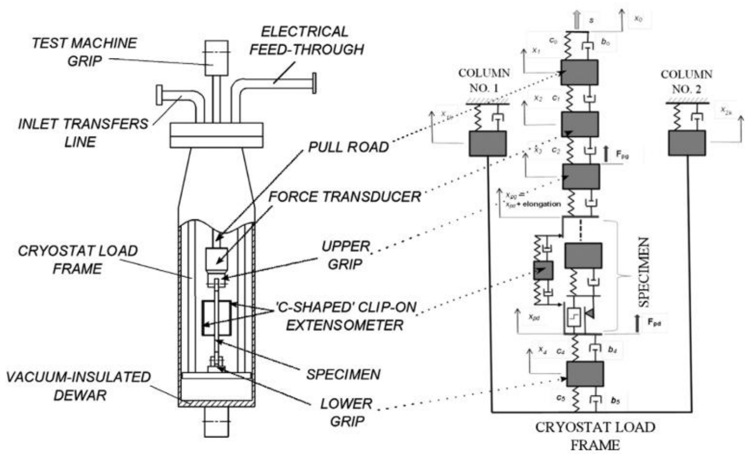


Figure 1. Schematic view of the experimental set-up (left) and extensometer (right) [2].

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[2] J. Tabin, M. Prącik, Methods for identifying dynamic parameters of clip-on extensometer–specimen structure in tensile tests, Measurement, Volume 63, 2015, Pages 176-186, ISSN 0263-224.