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M2Po2C-01 [37]: Pressure-induced critical current reduction in impregnated Nb₃Sn Rutherford cables for use in future accelerator magnets

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We analyze the measured critical current reduction in Nb₃Sn Rutherford cables under magnet-relevant transverse pressure levels in terms of the filament strain inside their strands. A mechanical 2D model of cables' cross-section is developed to translate the stress that is applied to the surface of the impregnated cables into a strain distribution on the surface of its strands. The resulting critical current of the cable is then used to estimate the corresponding deviatoric strain on the intra-strand filamentary level, using the well-documented strain scaling relations obtained for the isolated strands. By comparing the thus modelled strain on a strand level with the estimated strain on a filament level, we can identify the main factors that influence the pressure response of these accelerator cables. Such an analysis is presented for four state-of-the-art cable samples that were measured at the University of Twente (combining two cable- and two strand-types) and discussed in terms of cable lay-out and mechanical strand properties.

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