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Evidence of nonlinear acoustic behaviour in concrete constructions and the meso- and macro-scale

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It is known since long that concrete, including its reinforced and prestressed variants, shows nonlinear elastic behaviour on the meso (material) and macro (construction) scale. For about two decades scientist have made connections to nonlinear acoustic properties, mostly determined by ultrasonic measurements. The focus has been on coda wave interferometry and the so-called classic nonlinearity, e.g. an approximately linear dependence of ultrasonic velocity and stress. The practical application on a commercial scale is in preparation. However, there is more to it: Higher order nonlinearities, including slow dynamics, have been observed in lab experiments, but also at full scale models and real structures including bridges and a metro tunnel. The talk gives an overview of recent studies at BAM, the preliminary interpretation and the potential for exploitation.

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