The aim of the thesis is the mathematical and computer modelling of thin films of martensitic materials. We derive a thermodynamic thin-film model on the meso-scale that is capable of capturing the evolutionary process of the shape-memory effect through a two-step procedure. First, we apply dimension reduction techniques in a microscopic bulk model, then enlarge gauge by neglecting microscopic interfacial effects. Computer modelling of thin films is conducted for the static case that accounts for a modified Hadamard jump condition which allows for austenite--martensite interfaces that do not exist in the bulk. Further, we characterize $L^p$-Young measures generated by invertible matrices, that have possibly positive determinant as well. The gradient case is covered for mappings the gradients and inverted gradients of which belong to $L^\infty$, a non-trivial problem is the manipulation with boundary conditions on generating sequences, as standard cut-off methods are inapplicable due to the determinant constraint. Lastly, we present new results concerning weak lower semicontinuity of integral functionals along (asymptotically) $\mathcal{A}$-free sequences that are possibly negative and non-coercive.