

## Abstract

In this monograph we develop various aspects of the homotopy theory of exact categories. We introduce different notions of compactness and generation in exact categories, and use these to study model structures on categories of chain complexes  $Ch_*(\mathcal{E})$  which are induced by cotorsion pairs on  $\mathcal{E}$ . As a special case we show that under very general conditions the categories  $Ch_+(\mathcal{E})$ ,  $Ch_{\geq 0}(\mathcal{E})$ , and  $Ch(\mathcal{E})$  are equipped with the projective model structure, and that a generalisation of the Dold-Kan correspondence holds. We also establish conditions under which categories of filtered objects in exact categories are equipped with natural model structures. When  $\mathcal{E}$  is monoidal we also examine when these model structures are monoidal and conclude by studying some homotopical algebra in such categories. In particular we provide conditions under which  $Ch(\mathcal{E})$  and  $Ch_{\geq 0}(\mathcal{E})$  are homotopical algebra contexts, thus making them suitable settings for derived geometry.