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Monotone-light factorisation systems and torsion theories

Given a torsion theory $(\mathbb{Y}, \mathbb{X})$ in an abelian category $\mathbb{C}$, the reflector $I\colon \mathbb{C} \to \mathbb{X}$ to the torsion-free subcategory $\mathbb{X}$ induces a reflective factorisation system $(\mathcal{E}, \mathcal{M})$ on $\mathbb{C}$. It was shown by A. Carboni, G. Janelidze, G.M. Kelly and R. Paré in [1] that $(\mathcal{E}, \mathcal{M})$ induces a so-called monotone-light factorisation system $(\mathcal{E}', \mathcal{M}^*)$ by simultaneously stabilising $\mathcal{E}$ and localising $\mathcal{M}$, whenever the torsion theory is hereditary and any object in $\mathbb{C}$ is a quotient of an object in $\mathbb{X}$. We extend this result to arbitrary normal categories, and improve it also in the abelian case, where the heredity assumption on the torsion theory turns out to be redundant [2]. Under suitable assumptions, the reflective subcategory $\mathcal{M}^*$ of coverings in the category $\mathsf{Arr}(\mathbb{C})$ of arrows in $\mathbb{C}$ induces monotone-light factorisation systems in the category $\mathsf{Arr}^n(\mathbb{C})$ of n-fold arrows. Many new examples of torsion theories where this result applies are then considered in the categories of abelian groups, groups, topological groups, commutative rings, and crossed modules.

This is joint work with Marino Gran.

References

[1] A. Carboni, G. Janelidze, G.M. Kelly and R. Paré, *On localization and stabilization of factorization systems*, Appl. Categ. Structures 5, 1-58 (1997)

[2] T. Everaert and M. Gran, *Monotone-light factorisation systems and torsion theories*, accepted for publication in Bull. Sciences Mathém.