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# Morita equivalence of semigroups revisited: Firm semigroups[☆]

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**Abstract**

We define firm semigroups and firm acts as non-additive analogues of firm rings and firm modules. Using the categories of firm acts we develop Morita theory for firm semigroups. We show that equivalence functors between categories of firm acts over two firm semigroups have to be tensor multiplication functors. Our main result states that the categories of firm right acts over two firm semigroups are equivalent if and only if these semigroups are strongly Morita equivalent, which means that they are contained in a unitary Morita context with bijective mappings.

We also investigate other categories of acts which have been used earlier to develop Morita equivalence. The main tool in our work is adjoint functors. We prove that over firm semigroups all the considered categories are equivalent to the category of firm acts.

All this suggests that firm semigroups and firm acts are the natural environment to study Morita equivalence of semigroups.

*Keywords:* Firm semigroup, firm act, unitary act, Morita equivalence, strong Morita equivalence, adjoint functors, localization, colocalization.
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