Dynamical characteristics of linear cellular automata are discussed algebraically, whose cell space and state space are an Abelian group and a finite commutative ring, respectively, instead of a lattice space and a residue class. One of the main results is a characterization of the dynamical structures with relation to what the unit configuration is. It is also shown that a linear cellular automaton with the state space of a residue class of an integer m can be decomposed in parallel into automata with the one of a power of a prime which is a factor of m. Using those results, the proofs of known results are improved concerning C-surjectivity, C-injectivity, and finite-order property for linear cellular automata and presented in a unified manner.

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