Parallel maps for cellular automata have a remarkable feature that the injectivity and
reversibility for parallel maps is equivalent. In particular, injectivity, reversibility and
surjectivity are all equivalent for parallel maps with scope 1. These relations are hold if
we take a finite set as a state set of the automata. However, if we take an infinite set as a
state set, even in linear case, it does not always hold.

On the other hand, in linear algebra, the following Proposition is well known.
“ In square matrix, injectivity surjectivity and non-singularity are all equivalent”.

It suggests that parallel maps for cellular automata over vector spaces satisfy
Richardson’s
Relation. Indeed it is true, in this paper, we generalize linear algebra from the viewpoint
from cellular automata.