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Convergence properties of the law of reproduction by the first principle derivation in population dynamics

We want to relate the law of reproduction with interaction between individuals. For this purpose, we use the form of infinite series, which is called “first principle derivation” [5, chapter 4]. By this method, we can derive the population reproduction function from the relationships of individuals (the distribution function of individuals and the interaction function between individuals). Previous research[1, 5] has derived a few concave functions, which are Ricker model and Skellam model. We extended previous research in economical viewpoint. As a result, we could derive new types of function like Holling’s type III functional response [2], so we could represent bistability in population dynamics[3]. The reason comes from the fact that the derived function has convexity in case that population is small. Previous research did not have this property. Our model, in other hand, contains both density dependent effect and Allee effect. In order to clarify the mathematical properties of the law of reproduction from “first principle derivation”, we analysed the stability and bifurcation structure of fixed points of our infinite series function[4, chapter 2].

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