The Gerber-Shiu penalty function for two classes of risk processes with multi-layer dividend strategy

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Abstract

In this paper we consider a risk model with two classes of insurance risks in the presence of multiple thresholds. We assume that the two claim counting processes are, respectively, Poisson and Sparre Andersen with generalized Erlang(2) claim inter-arrival times. We derive an integro-differential system for the Gerber-Shiu functions for surplus-dependent premium rates and a piecewise integro-differential system in the multi-threshold case. Then we solve the above system in terms of the linearly independent solutions to the associated homogeneous system of the initial integro-differential equation system. An analysis of this homogeneous integro-differential systems is done using Laplace transforms. Then we provide a recursive approach to obtain the general solution of the Gerber-Shiu functions. Finally, to illustrate the solution procedure, explicit expressions for the two types Laplace transforms of the time to ruin and the ruin probabilities are given when the claim sizes are exponentially distributed.

Keywords. Compound Poisson process, Generalized Erlang risk process, Penalty functions, Multi-layer dividend strategy, Intergro-differential equations system, Rationally distributed claim severities, Laplace transform of the time to ruin, Ruin probabilities.

References

[1] Albrecher, H., Hartinger, J. 2007. A risk moel with multi-layer dividend strategy. North American Actuarial Journal 11(2), 43-64.

[2] Chadjiconstantinidis, S., Papaioannou, A.D., 2009. Analysis of the Gerber-Shiu function and dividend barrier problems for a risk process with two classes of claims. Insurance: Mathematics and Economics, 45, 470-484.

[3] Gerber, H.U., Shiu, E.S.W., 2005. The time value of ruin in a Sparre Andersen model. North American Actuarial Journal 9, 49-69.

[4] Li, S., Garrido, J., 2005. Ruin probabilities for two classes of risk processes. ASTIN Bulletin 35, 61-77.