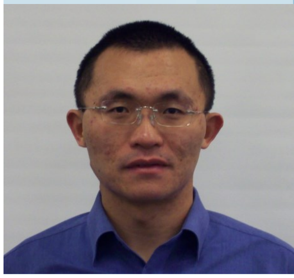
Volume 2, Number 3 June 2015

Interdisciplinary collaboration between engineering, mathematics and science

SEMS Research Highlights



Alternative Expectation Equations for Nonnegative Continuous Random Variables

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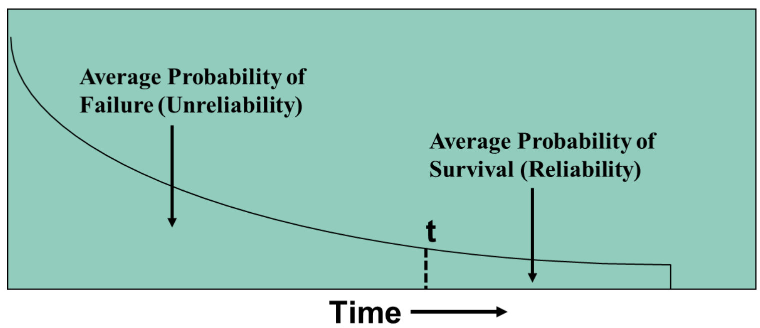
This newsletter presents the research conducted within the School of Engineering, Mathematics and Science (SEMS) at Robert Morris University (RMU). It covers various relevant topics including: interdisciplinary efforts, successful research grants, student research, posters and papers, journal publications, presentations at national and international conferences, contribution to professional societies, STEM educational research, industrial consulting collaborations and applied research.



Students in a calculus-based probability course often see the expectation formula for non-negative continuous random variable in terms of a survival function. For example, Figure (1) depicts a survival function where X-axis represents time while Y-axis represents the probability that an entity will survive for time ***t***. The entity can be life of a system, a component or a machine or even a human being. For example when time is short, it is expected that the entity will be surviving at that time while as time increases the probability that the entity will fail also increases. However, an important question is if there are two entities, is an equation available that might help one to calculate their covariance using their joint survival function? Taking it further one may be interested in finding an equation for multivariate version of this equation where infinite number of entities coexist in a system. Such an equation would have direct applications in actuarial science, demography, reliability theory and survival analysis. This paper answers these questions affirmatively and presents the equations along with the theoretical proof that the bivariate and multivariate versions of the survival equations can be established. The univariate survival function is given in Eq. (1) while the bivariate survival function is shown in Eq. (2). For multivariate equation, pl. visit the website: https://sites.google.com/a/rmu.edu/lhong/publications

$$E(X) = \int_0^{+\infty} S(x)dx$$

Eq. (1)

$$E[XY] = \int_0^{+\infty}\int_0^{+\infty} S(x,y)dxdy$$

Eq. (2)

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