Analysis of Censored Data
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CENSORING IN THEORY AND PRACTICE : STATISTICAL PERSPECTIVES AND CONTROVERSIES [†]

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Abstract

For various types of censoring in reliability and survival analysis, relevant statistical theory and methodology rest on some basic regularity assumptions which may not always be tenable in practice. The impact of less than ideal regularity assumptions on validity and robustness of statistical procedures is examined, and statistical perspectives and controversies are discussed with due emphasis on biomechanistics.

1. Introduction. Censoring relates to lifetime data analysis for mechanistic or biologic system. Replacement of failed components by new ones prolongs the life of a mechanistic system, while such a replacement (or *perfect repair*) may not always be feasible in a biologic system. In either context, censoring may be defined as a termination of the observation-life due to some cause(s) other than the natural failure to which the system is subjected. To appreciate this broad interpretation of censoring and to comprehend the usual complexities of statistical procedures for such censoring schemes, we pressure a distinction between mechanistic and biologic systems, for which the underlying regularity assumptions may vary considerably, and may call for somewhat different statistical approaches. In *biomechanistics*, i.e., *life-testing models* relating to biologic systems, there are biological undercurrents, and often, standard statistical analysis of censored data does not work out well. On the other hand, reliability theory with its genesis in mechanistic systems is more appropriate in operations research and systems analysis setups. The main difference between the two setups is the basic fact that in biologic systems, sickness or substandard *Quality of Life* may, often, precede a failure, and that may call for more complex models. The

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[†]*Key words and phrases.* Biomechanistics; censoring: Type I, II, progressive and random; clinical trials; competing risk; mechanistics; proportional hazard model; reliability theory; repairability; robustness; staggered entry; surrogate variables; survival analysis; time-sequential test; validity.