Meeting: 1000, Albuquerque, New Mexico, SS 5A, Special Session on Categories and Operads in Topology, Geometry, Physics and Other Applications

1000-68-146 **Hanna E. Makaruk*** (hanna_m@lanl.gov), LANL, Ms E548, P-22, Los Alamos, NM 87545, **Robert M. Owczarek** (rmo@lanl.gov), LANL, Los Alamos, NM 87545, and **Nikita A. Sakhanenko** (sanik@cs.unm.edu). *Vector space of paths and completeness of White-Box software testing.* Preliminary report.

A mathematical model of White-Box software testing and an effective testing method based on it are proposed. We call a White-Box test complete when each statement of the code is executed at least once. One can view a program as a control flow graph, which is directed and strongly connected due to the existence of virtual edge from End to Begin. Assumptions on the graph constructs ensure that each edge is traversed at most once during execution of a path. Vector with elements equal to 1 if a corresponding edge is in a path or 0 if it is not represents an execution path. Vector space of paths over Z2 is built. Its dimension is equal to the number of independent paths in the graph. It is equal to cyclomatic complexity, easily computed for a strongly connected graph. Checking if pre-selected paths are independent simplifies to checking linear independence of vectors. In many cases, like sequential or parallel modularity, space of the paths can be decomposed into a tensor product of linearly independent subspaces. It simplifies identification of independent paths and provides support for bug localization. Method for identifying the base in the vector space of execution path is proposed. To complete a White-Box test it is sufficient to execute base pats only. (Received August 23, 2004)