Ain Shams Engineering Journal (2014) 5, 449–473

Ain Shams University

Ain Shams Engineering Journal

www.elsevier.com/locate/asej
www.sciencedirect.com

ELECTRICAL ENGINEERING

Consolidity: Stack-based systems change pathway theory elaborated

Hassen Taher Dorrah *

Department of Electrical Engineering, Faculty of Engineering, Cairo University, Giza 12613, Egypt

Received 12 October 2013; revised 7 December 2013; accepted 19 December 2013
Available online 24 January 2014

KEYWORDS

Natural sciences and engineering;
System change pathway theory;
Consolidity theory;
"Time driven-event driven-parameters change" paradigm;
Stack-based system change classifications and categorization;
Fractals-general stacking system behavior

Abstract This paper presents an elaborated analysis for investigating the stack-based layering processes during the systems change pathway. The ***system change pathway*** is defined as the path resulting from the combinations of all successive changes induced on the system when subjected to varying environments, activities, events, or any excessive *internal* or *external* influences and happenings "***on and above***" its normal stands, situations or set-points during its course of life. The analysis is *essentially* based on the important overall system paradigm of "***Time driven-event driven-parameters change***". Based on this paradigm, it is considered that any affected activity, event or varying environment is *intelligently* self-recorded inside the system through an incremental consolidity-scaled change in system parameters of the stack-based layering types. Various joint stack-based ***mathematical*** and ***graphical*** approaches supported by *representable* case studies are suggested for the identification, extraction, and processing of various stack-based systems changes layering of different ***classifications*** and ***categorizations***. Moreover, some selected real life illustrative applications are provided to demonstrate the (infinite) stack-based identification and recognition of the change pathway process in the areas of geology, archeology, life sciences, ecology, environmental science, engineering, materials, medicine, biology, sociology, humanities, and other important fields. These case studies and selected applications revealed that there are general similarities of the stack-based layering structures and formations among all the various research fields. Such general similarities *clearly* demonstrate the global concept of the ***"fractals-general stacking behavior"*** of real life systems during their change pathways. Therefore, it is recommended that concentrated efforts should be expedited toward building **generic *modular stack-based systems or blocks*** for the mathematical, programming and hardware representations of each stack layering type to serve in reducing *tremendously* any repetitive research efforts in future handling of *similar* or *analogous* problems of real life systems. Finally, a new global inter-related stack-based configuration in ***multi-stacking networks*** is proposed incorporating *conceptually* the mutual stack-based changes balancing process through assumed ideal case of *lossless* bi-directional transfer ***piping systems***.

* Tel.: +20 (2) 33368749, mobile: +20 (2) 1222189739; fax: +20 (2) 33368748.
E-mail address: dorrahht@aol.com.

Peer review under responsibility of Ain Shams University.

ELSEVIER Production and hosting by Elsevier

2090-4479 © 2014 Production and hosting by Elsevier B.V. on behalf of Ain Shams University.
http://dx.doi.org/10.1016/j.asej.2013.12.002

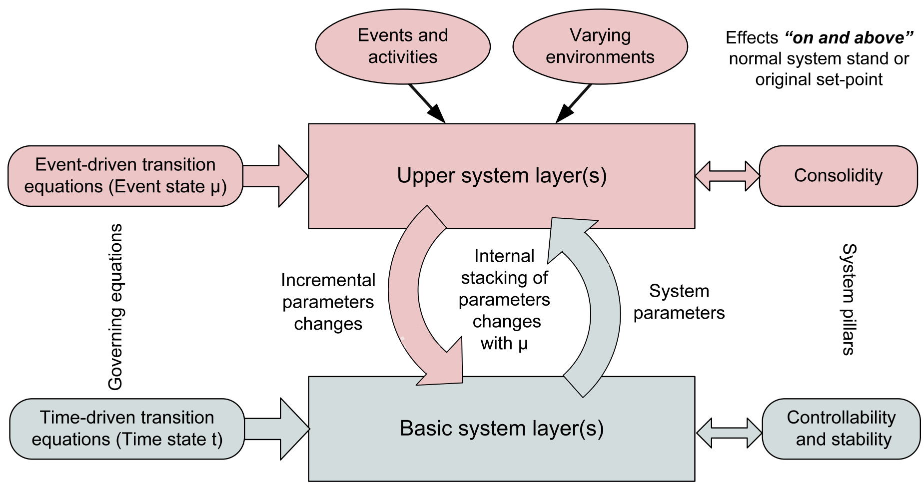

Figure 1 The ***conceptual*** diagram showing the joint two-level of ***basic*** and ***upper system layers*** configuration with their interactions representation for manipulating systems change pathways [1].

1. Introduction

The system joint "***time-driven***" and "***event-driven***" configuration has recently been revealed in [1]. Such configuration is based on a two-level form where the basic level represents the time scale "*t*" governed physical system layer(s), and the upper level is the influencing event layer(s). While the *basic level* is usually subject to normal operation disturbances that can be absorbed by the physical system behavior, the *upper level* is subject to events, activities and varying environments "***on and above***" the normal system operation. Other examples of the upper level effects are any external or internal *excessive influences and happenings* affecting the system such as accidents, collisions, impacts, breaks, shocks, collapses, eruptions, and destructions. Such upper level operation leads at each event occurrence to corresponding parameter changes in the physical system layer(s) at the lower level [2–4].

Consolidity (the *act* and *quality* of consolidation) is a new notion measured by the systems output reactions versus combined input/system parameters reaction when subjected to varying environments and events [1]. System consolidity is expressed by the *consolidity index* denoted in this paper by C. The system is defined to be *consolidated* if $C < 1$, *neutrally consolidated* if $C \approx 1$ and *unconsolidated* if $C > 1$ [5,6]. Such consolidity index plays an essential role in governing system parameters changes due to the events "***on and above***" normal operation during the system change pathway and acts mainly at the upper event-driven level.

System parameters change during the ***change pathway***[1] is transformed to corresponding changes in the system physical layer(s) at the basic level, within the framework of consolidity [1]. The changes follow a stack-based behavior of different classes and categories defined in the most general sense, where at the front of the stack is located the most recent changes and so on for each preceding ones.[2] Examples of stack classes are changes above, beneath, sided, outward, inward, and within the system layers. The change categories are growing, shrinking or growing/shrinking depending on the direction of such changes.

The above analysis provides the foundation for the global stack-based change pathway theory that can be applied to ***everywhere*** systems in various sciences and disciplines. Within the framework of the change pathway theory, it is considered that every system is intelligently conducting ***autonomous self-recording*** of its affected varying environments or events through inducing corresponding (infinite) stack-based changes in the system parameters [1]. Therefore, the first step in expediting the progress of the theory is the full understanding of different types of stack-based layering changes in real life system. This covers investigating the important problem of stack-based layering changes identification, extraction, and processing. Such problem is the main target of the present paper, to be carried out in a *systematic* way supported by many real life *explanatory* examples from various disciplines and sciences.

2. Problem description

2.1. Joint two-level systems configuration

The main configuration of real life ***natural*** or ***man-made*** systems is based on joint two-level operation as shown in the conceptual graph of Fig. 1. The basic level is governed by the time-driven system physical equations, while the upper level is affected by activities, events and varying environments "***on and***

[1] The ***system change pathway*** is defined as the path resulting from the combinations of all successive changes induced on the system when subjected to varying environments, activities, events or any *internal* or *external* excessive influences and happenings "***on and above***" its normal stands, situations or set-points during its course of life.

[2] ***Stacking*** *linguistically* means "to *neatly put* or *arrange* (a number of things) in a more or less orderly pile or heap". For computer applications, ***stacking*** could be visualized as some sort of memory (arrays or layers) arrangement of items such that the item most recently arrived at the stack is the first to be retrieved. The *infinite stacking* property will permit accommodating apparently any number of elements in the stack due to its unlimited capacity. The terminology of stacking and its modeling techniques and formulations are intensively developed and are available *mainly* in the literature of Computer Science [7,8].