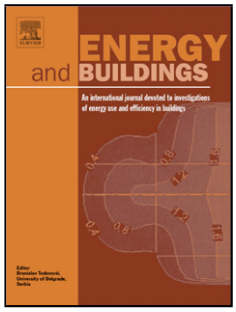

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Author: Bruno Malet-Damour Stéphane Guichard Dimitri Bigot Harry Boyer

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<AT>Study of Tubular Daylight Guide Systems in buildings: *Experimentation, modelling and validation*

<AU>Bruno Malet-Damour[a*] ##Email##bruno.malet-damour@univ-reunion.fr##/Email##, Stéphane Guichard[b], Dimitri Bigot[a], Harry Boyer[a]
<AU>
<AFF>[a]University of La Reunion, Physics and Mathematical Engineering Laboratory for Energy, Environment and Building (PIMENT) 117, rue du Général Ailleret 97 430 Le Tampon, France. Phone +262 (0) 692 81 95 96, Fax (+262) 96 28 59
<AFF>[b]Research Institute in Innovation and Business Sciences (IRISE) Laboratory\CESI-CCIR\CRITT The CESI engineering school, Campus Pro – CCIR 65 rue du Père Lafosse – Boîte n°4 97410 Saint-Pierre, France

<PA>Physics and Mathematical Engineering Laboratory for Energy, Environment and Building (PIMENT) University of La Réunion, 117, rue du Général Ailleret 97430 Le Tampon (France). Tel.: : 06 92 81 95 96.

<ABS-HEAD>Highlights► State of the art on the modelling light pipes performance ► A single experimental database for light pipes performance prediction. ► Development of a model generator based on genetic algorithms ► Development and validation of a new performance prediction model of a light pipe

<ABS-HEAD>Abstract

<ABS-P>In a concerning global energy context, the construction industry must be able to respond both in terms of energy management and the comfort of its buildings' occupants. In this context, innovative devices using daylighting can provide an obvious answer. The Tubular Devices Guide Systems (TDGS) are innovative daylighting processes based on light transport. They offer a real response to the diurnal energy consumption (frequently in tertiary). However, today's design will make tomorrow's building. This is why it is necessary to better adjust our prediction tools to optimize the use of these technologies and their coupling to active processes (artificial lighting). The literature reveals a disparity in performance prediction tools for light pipes. Two causes are targeted: the adjustment of semi-empirical models and their accuracy. This article offers some solutions to both problems. We propose a new form of model (improved accuracy) associated with a generalized modelling protocol (response to the adjustment) through a model generator named HEMERA. Our approach is organized around a Galilean sequence, i.e., we rely on observation and results of an experimental study in real weather conditions to better understand the phenomena and validate the developed model. Energy autonomy and user comfort in the building are at the heart of our concern, and we will provide evidence to validate the use of TDGS in buildings. In this context, we propose an energy equivalence between the light pipe and artificial lighting.

<KWD>Keywords: TDGS; Mirrored Light Pipe (MLP); Daylighting; Energy savings; HEMERA; Validation methodology; Model optimization; Building simulation

<td:DefL>Nomenclature