Extenso de CVU-TECNM

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Curriculum: **IT24A228**

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Resumen biográfico

Realice los posgrados (maestría y doctorado) en el Centro Nacional de Investigación y Desarrollo Tecnológico, CENIDET, bajo la dirección del Dr. Jesús Perfecto Xamán Villaseñor, en el área de sistemas térmicos. De febrero 2018 - abril 2019, realice una estancia doctoral en la Escuela Superior de Ingenierías Industrial, Aeroespacial y Audiovisual de Terrasa (ESEIAAT) de la Universidad Politécnica de Catalunya en Terrasa, Barcelona, España, donde elabore y colabore con estudios en energía en edificaciones y sus elementos de envolvente con el software OpenFOAM y un software propio de la institución. De diciembre 2022 - diciembre 2023, realice una estancia posdoctoral en la Universidad de Sonora, UNISON, donde se trabajo en el estudio teórico-experimental del impacto de la geometría de los techos con materiales de cambio de fase en el confort térmico de una habitación.

Con una trayectoria de más de 9 años, he participado activamente en el modelado numérico de sistemas solares pasivos para el ahorro de **Energía en Edificaciones**. He desarrollado códigos computacionales para el modelado de fenómenos físicos mediante métodos numéricos aplicados a la predicción del comportamiento térmico de sistemas solares pasivos y/o activos. He realizado modelación numérica de fenómenos de transferencia de calor conjugada mediante Dinámica de Fluidos Computacional (CFD) con el Método de Volumen Finito (FVM) tanto en coordenadas cartesianas como con coordenadas generalizadas (BFC). He trabajado (a nivel básico) en la modelación numérica de flujo turbulento bidimensional con la técnica de Ecuaciones de Navier-Stokes Promediadas de Reynolds (RANS) y con materiales de cambio de fase (PCM). Dicha modelación la he realizado con los lenguajes de programación *ForTran* y *C++*.

He participado en la elaboración de 4 artículos de divulgación científica, los cuales se encuentra publicados en revistas indexadas en el JCR.

Laboré en el Centro Nacional de Metrología, CENAM, en la dirección de termometría, la cual pertenece al área de metrología eléctrica. El proyecto sobre el cual se trabajo fue el desarrollo del sistema para la medición del poder calorífico de gases combustibles por un método primario.

Actualmente me encuentro laborando en el Instituto Tecnológico Superior de Teziutlán, como PTC adscrito a la carrera de Ingeniería Mecatrónica.

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PROFESOR ASOCIADO A en DIVISIÓN DE INGENIERÍA MECATRÓNICA *(2024-01-16 - Actualidad)*

Títulos académicos

2022-02-09 **DOCTORADO**, Doctor en Ciencias en Ingeniería Mecánica, CEDULA: 12826594, LUGAR DE ESTUDIOS: *Centro Nacional de Investigación y Desarrollo Tecnológico*

2017-01-09 **MAESTRíA**, Maestría en Ciencias en Ingeniería Mecánica, CEDULA: 11083512, LUGAR DE ESTUDIOS: *Centro Nacional de Investigación y Desarrollo Tecnológico*

2014-07-23 **LICENCIATURA**, Licenciatura en Ingeniería Electromecánica, CEDULA: 9705466, LUGAR DE ESTUDIOS: *Instituto Tecnológico Superior de Tlaxco*

Productividad académica

Artículo

2023-01-07 **Thermal performance of a window shutter with a phase change material as a passive system for buildings in warm and cold climates of México**

Autor(es): *M. Che-Pan, E. Simá, A. Ávila-Hernández, J. Uriarte-Flores, R. Vargas-López*

This paper shows the thermal performance of a window system with a shading cover made out of a phase change material (window-PCM shutter). The analysis was the numerical study where conjugated heat transfer was considered on the whole system window-PCM shutter. The modeling was conducted under warm (Merida) and cold weather (Toluca) conditions in México for the warmest and coldest day. Two different phase change materials (PCMs) were selected for the study: Paraffin wax - MG29 and noctadecane. The results show that the n-octadecane and the MG29 were capable of keeping the inside comfort temperature for 14:35 and 16:23 h, respectively. The n-octadecane and MG29 reduced the energy of the window-PCM shutter inside surface by 67.3 and 71.6%, respectively, compared to a conventional window. Under cold weather conditions also occurred reductions of heat fluxes by 87.2 (n-octadecane) and 83% (MG29) with the window-PCM shutter system compared to a conventional window, causing non-comfort temperatures. The use of a window-PCM shutter is highly recommended under warm weather conditions, given that it showed to be a viable option for energy savings in buildings; however, for its implementation under cold weather conditions of México, it becomes necessary further investigations with other PCMs.

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DIRECCION ELECTRÓNICA: *https://doi.org/10.1016/j.enbuild.2023.112775*

PROPÓSITO: *Generación de Conocimiento*; SECTOR → DISCIPLINA: (Medio Ambiente → Eficiencia energética)

2018-12-15 **Thermal performance of walls with passive cooling techniques using traditional materials available in the Mexican market**

Autor(es): *J. Uriarte-Flores, J. Xamán, Y. Chávez, I. Hernández-López, Nelson O. Moraga, J.O. Aguilar*

The numerical thermal performance of walls made out with materials available on the Mexican market: red brick (L), solid block (T) and hollow block (B) is presented. Each wall with a passive cooling technique was studied for a period of 24 h (warmest and coldest days) for three cities of Mexico with predominantly warm weather (Merida, Zacatepec and Hermosillo). In order to carry out the thermal analysis of each wall, four configurations were defined as follows: L, T and B stand for red brick, solid block or hollow block as the construction material respectively, and the numbers 1, 2, 3 and 4 stand for an added single layer of plaster (reference case) (1), an added layer of plaster plus a layer of white reflective coating (2), an added layer of insulating material plus a layer of plaster (3), an added layer of insulating material, plus a layer of plaster plus a layer of white reflective coating (4), giving as a result alternate configurations defined as (L1), (L2), (L3), (L4), (B1), …, (T4). In general, results showed that configurations L1, T1 and B1 increased considerably the total thermal load in all the three cities, compared to configurations L4, T4 and B4, respectively. For the city of Merida, Zacatepec and Hermosillo, configuration T4 resulted with the lowest thermal loads: 983.75, 1095.5 and 1540.72 W-h/m2, while configuration T1 had the highest thermal loads: 1831.22, 1859.86 and 2686.91 W-h/m2, which represents an increase of 48.8, 41.1 and 42.7% regarding to configuration T4, respectively. Finally, the configuration with the lowest thermal loads and economically viable based on the recovery of investment time was configuration T4, with a recovery time lower than 60 months and a reduction on the thermal loads between 41.1 and 48.8%. On the other hand, the recovery time for configuration B4 went beyond 115 months and the reduction on the thermal loads varied between 34 and 42%.

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PROPÓSITO: *Generación de Conocimiento*; SECTOR → DISCIPLINA: (Medio Ambiente → Eficiencia energética)

2018-05-22 **X-factor: A modified relaxation factor to accelerate the convergence rate of the radiative transfer equation with high-order resolution schemes using the Normalized Weighting-Factor method**

Autor(es): *J. Xamán, I. Hernández-López, J. Uriarte-Flores, I. Hernández-Pérez, I. Zavala-Guillén, P. Moreno-Bernal, J.F. Hinojosa*

In this paper the high computational cost problem by using high-order (HO) and high-resolution (HR) schemes is addressed and for that, we propose the incorporation of a modified relaxation factor to accelerate the numerical solution of the radiative transfer equation (RTE) using the Normalized Weighting-Factor (NWF) method to implement several high-order resolution schemes. The modified relaxation factor to accelerate the convergence rate is based on the artificial incorporation of a semi-implicit X-factor. This procedure is denoted as the X-factor method. The X-factor method is compared, in terms of computer time needed to obtain a converged solution, with the widely used deferred-correction (DC) method for the calculations of a two-dimensional cavity with emitting–absorbing–scattering gray media using the discrete ordinates method. Four parameters are considered to evaluate the purpose of this paper: the absorption coefficient, the emissivity of the boundary surface, the under-relaxation factor, and the scattering albedo. In general, the results showed that using the X-factor procedure there is superiority over the DC procedure for reducing the CPU time when the DIAMOND, QUICK, SMART and WACED schemes are used. Additionally, the results showed that the CPU time for the MUSCL scheme can be smaller than that obtained with the DC method. The absorption coefficient effect showed that the X-factor method provided a reduction of CPU time between 20 and 211%. The results of emissivity effect showed that the computational time decreases between 2 and 162% by using the X-factor procedure. Regarding the effect of the under-relaxation factor, the results showed that X-factor method provided reductions of the CPU time from 52 to 181%. Analogously, the results for the scattering albedo showed that the X-factor method reduced the CPU time by a factor ranging between 4 and 219%. Additionally, a second test case was presented and the results showed that our code produces the same solution considering the use of DC method, X-factor method and several high-order resolution schemes. Results clearly demonstrated the

effectiveness of the X-factor method to reduce the CPU time and therefore, the X-factor method can potentially be used in commercial software and in-house codes due to the substantial reduction of the computational cost.

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PROPÓSITO: *Generación de Conocimiento*; SECTOR → DISCIPLINA: (Tecnologías de la Información y Comunicaciones → Computación)

2018-01-09 EVALUATION OF THE CPU TIME FOR SOLVING THE RADIATIVE TRANSFER EQUATION WITH HIGH-ORDER RESOLUTION SCHEMES APPLYING THE NORMALIZED WEIGHTING-FACTOR METHOD

Autor(es): *J. Xamán, I. Zavala-Guillén, I. Hernández-López, J. Uriarte-Flores, I. Hernández-Pérez, E.V. Macías-Melo, K.M. Aguilar-Castro*

In this paper, we evaluated the convergence rate (CPU time) of a new mathematical formulation for the numerical solution of the radiative transfer equation (RTE) with several High-Order (HO) and High-Resolution (HR) schemes. In computational fluid dynamics, this procedure is known as the Normalized Weighting-Factor (NWF) method and it is adopted here. The NWF method is used to incorporate the high-order resolution schemes in the discretized RTE. The NWF method is compared, in terms of computer time needed to obtain a converged solution, with the widely used deferred-correction (DC) technique for the calculations of a two-dimensional cavity with emitting–absorbing–scattering gray media using the discrete ordinates method. Six parameters, viz. the grid size, the order of quadrature, the absorption co-efficient, the emissivity of the boundary surface, the under-relaxation factor, and the scattering albedo are considered to evaluate ten schemes. The results showed that using the DC method, in general, the scheme that had the lowest CPU time is the SOU. In contrast, with the results of the DC procedure the CPU time for DIAMOND and QUICK schemes using the NWF method is shown to be, between the 3.8 and 23.1% faster and 12.6 and 56.1% faster, respectively. However, the other schemes are more time-consuming when the NWF is used instead of the DC method. Additionally, a second test case was presented and the results showed that depending on the problem under consideration, the NWF procedure may be computationally faster or slower that the DC method. As an example, the CPU time for QUICK and SMART schemes are 61.8 and 203.7%, respectively, slower when the NWF formulation is used for the second test case. Finally, future researches to explore the computational cost of the NWF method in more complex problems are required.

REVISTA: Journal of Quantitative Spectroscopy and Radiative Transfer - *ELSEVIER* (pags. 45-63), *MÉXICO*; ISSN: 0022-4073; INDEXADO EN: JCR
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PROPÓSITO: *Investigación Aplicada*; SECTOR → DISCIPLINA: (Tecnologías de la Información y Comunicaciones → Sistemas computacionales)