

Modelagem híbrida do processo de combustão

Fronteira imersa para escoamentos com massa específica variável

Modelos de micro mistura / Escoamentos reativos com cinética química detalhada

Comparação com dados experimentais do caso PaSR

Estrutura de dados das partículas PDF
(Linked List – Hash Table) / (Fortran – C)

“Considering the stochastic nature of turbulence, it is remarkable how little probability theory is used in most theoretical approaches to the subject.”

S. B. Pope

$$f_{\emptyset}(\Psi) \equiv \frac{dF_{\emptyset}(\Psi)}{d\Psi} \quad (1)$$

$$F_{\emptyset}(\Psi) \equiv P(\emptyset < \Psi) \quad (2)$$

*Velocity-Composition Joint
PDF*

Hybrid LES/PDF Methodology

Modelo de Interação de Troca com a Média (IEM)

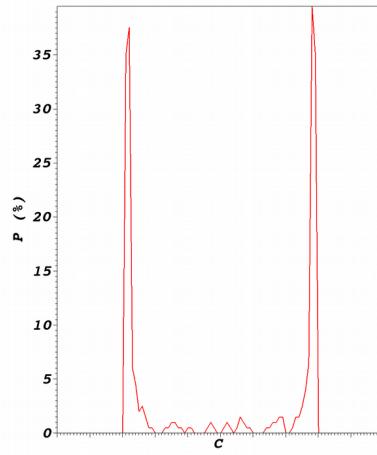
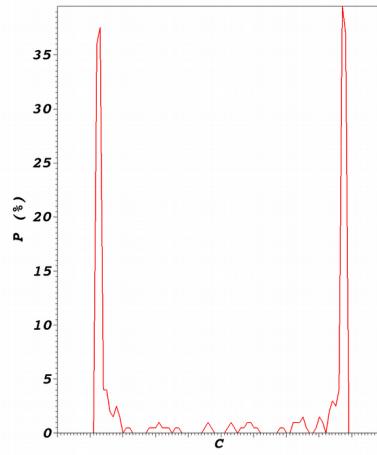
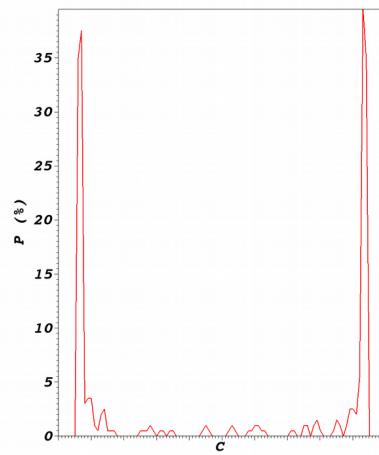
$$\frac{dC^{(n)}}{d\alpha} = S(C^{(n)}) + \frac{1}{t_m} (\langle C \rangle - C^{(n)}) \quad (3)$$

$$\frac{1}{t_m} = \beta \cdot \left(\frac{\nu}{Sc \cdot \Delta^2} \right) \quad (4)$$

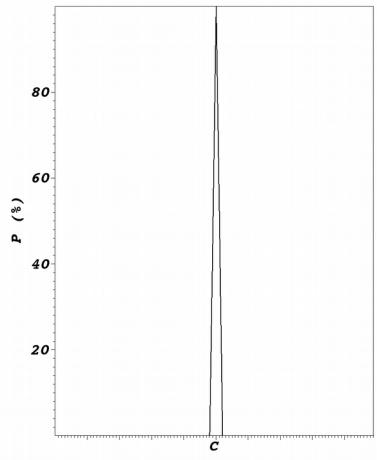
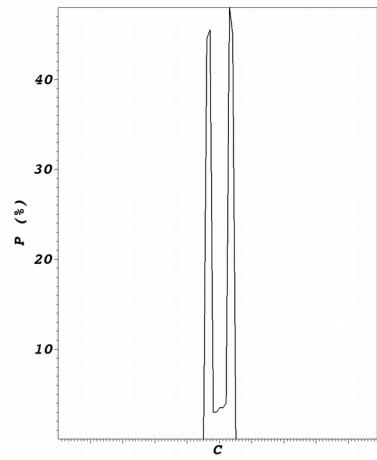
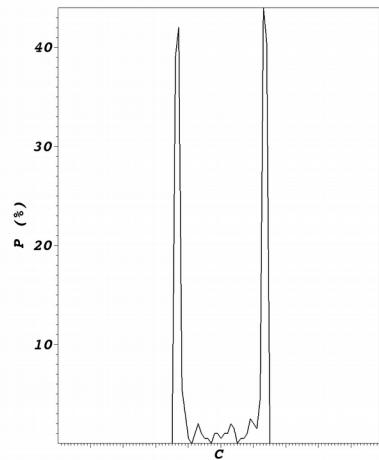
“Note that the IEM model contains no spatial structure due to the assumption that the vessel is well macromixed.”

R. O. Fox

Tempo: 10^2 (s)



Tempo: 10^3 (s)



(I)

(II)

(III)

Estrutura de dados

Análise
assimptótica

Linked List

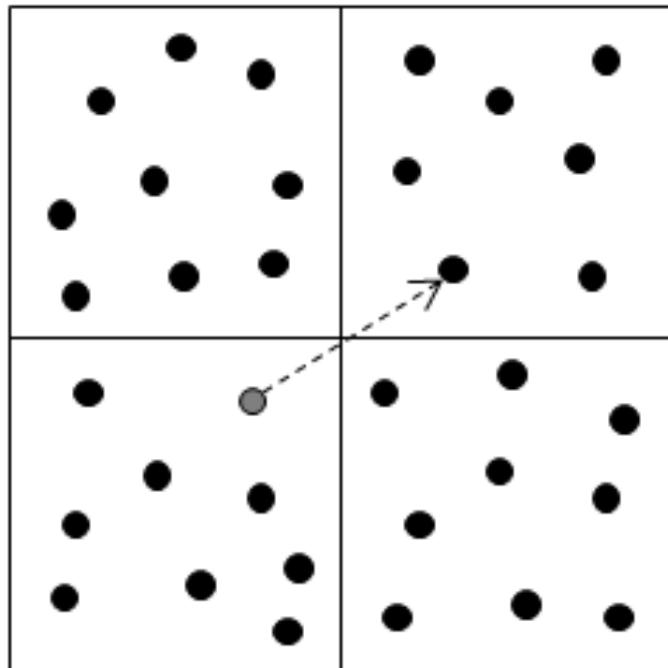
Array-Based List

Hash Table

***HASH TABLE* MÚLTIPLA APLICADA NO GERENCIAMENTO DE
PSEUDO-PARTÍCULAS EM DOMÍNIO EULERIANO**

**REATOR PARCIALMENTE AGITADO UTILIZANDO *HASH
TABLE***

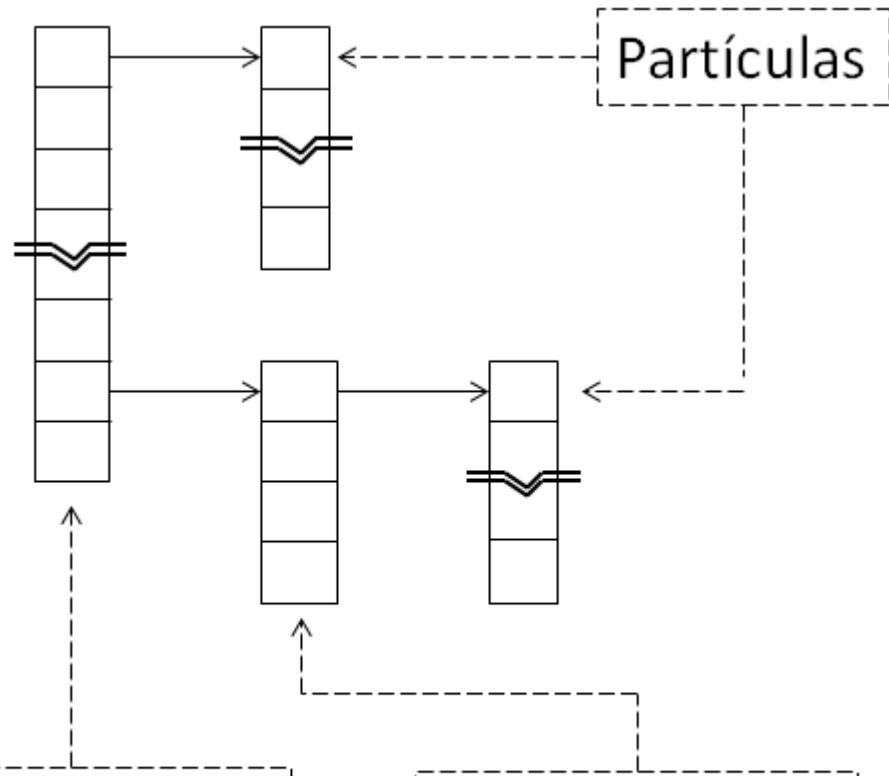
Dado um volume euleriano,
quais partículas estão
geometricamente contidas
nele?



→ *Hash
Table*

Dada uma partícula, ao qual
volume ela pertence?

→ *Algoritmo de
Busca*



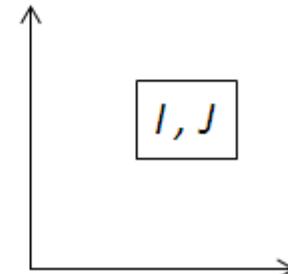
Volumes
(1º nível físico)

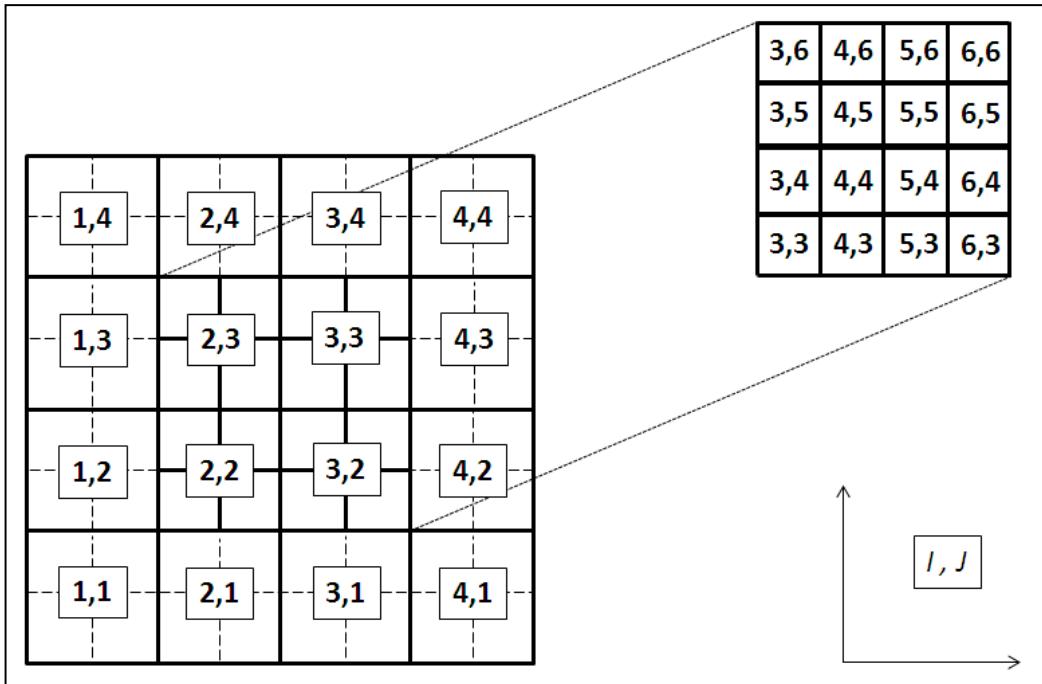
Volumes
(2º nível físico)

.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.

$1,4$	$2,4$	$3,4$	$4,4$
$1,3$	$2,3$	$3,3$	$4,3$
$1,2$	$2,2$	$3,2$	$4,2$
$1,1$	$2,1$	$3,1$	$4,1$

$3,6$	$4,6$	$5,6$	$6,6$
$3,5$	$4,5$	$5,5$	$6,5$
$3,4$	$4,4$	$5,4$	$6,4$
$3,3$	$4,3$	$5,3$	$6,3$





3,6	4,6	5,6	6,6
3,5	4,5	5,5	6,5
3,4	4,4	5,4	6,4
3,3	4,3	5,3	6,3

Dados:

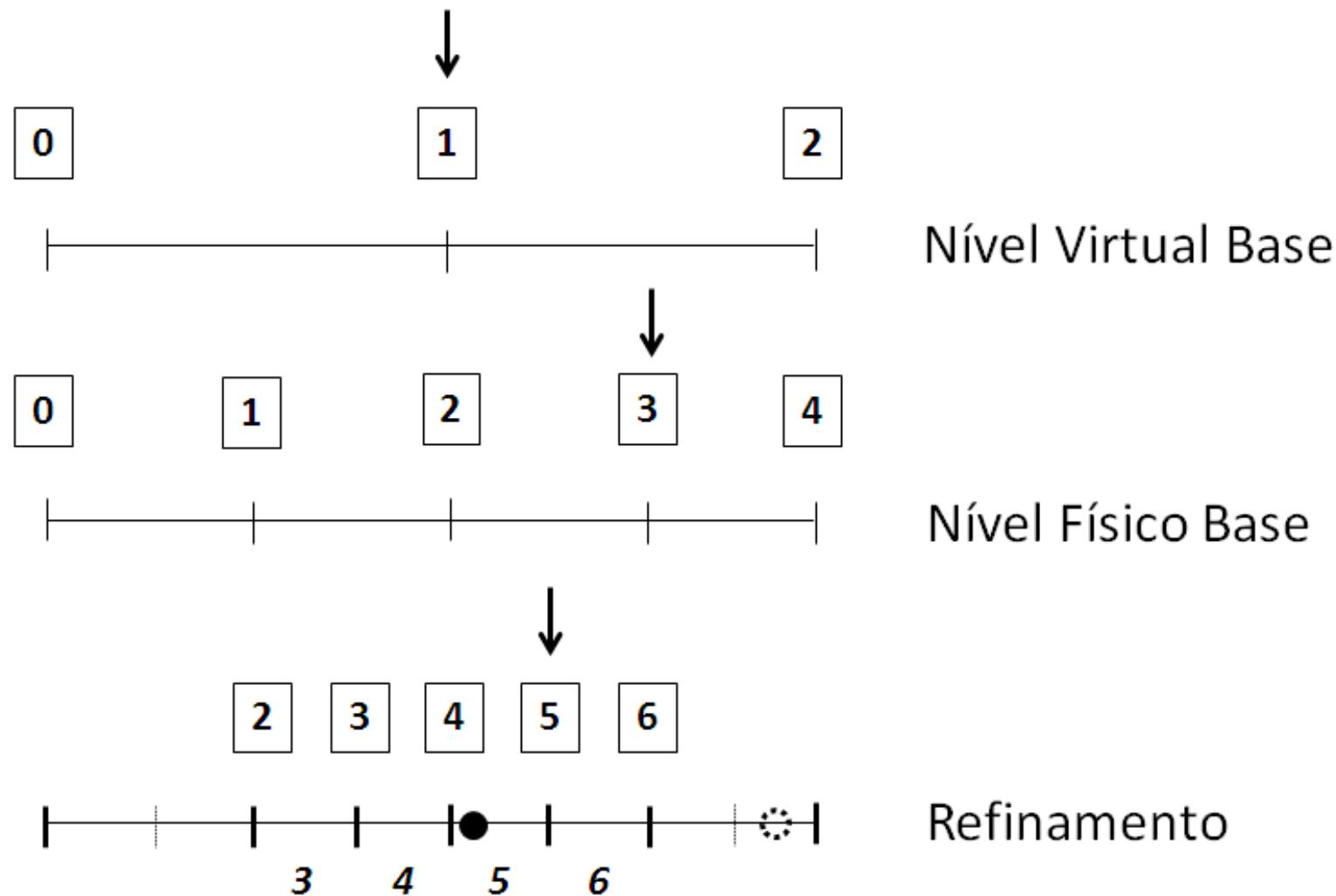
$$\Omega [0, 1]$$

$$\Delta^{\text{nível}} = \{0.25, 0.125\}$$

Partícula {0.6, 0.45, Z}

Volume {5, 4, K}

$$I = f \left(\frac{X - X_0}{\Delta^{\text{nível}}} \right)$$



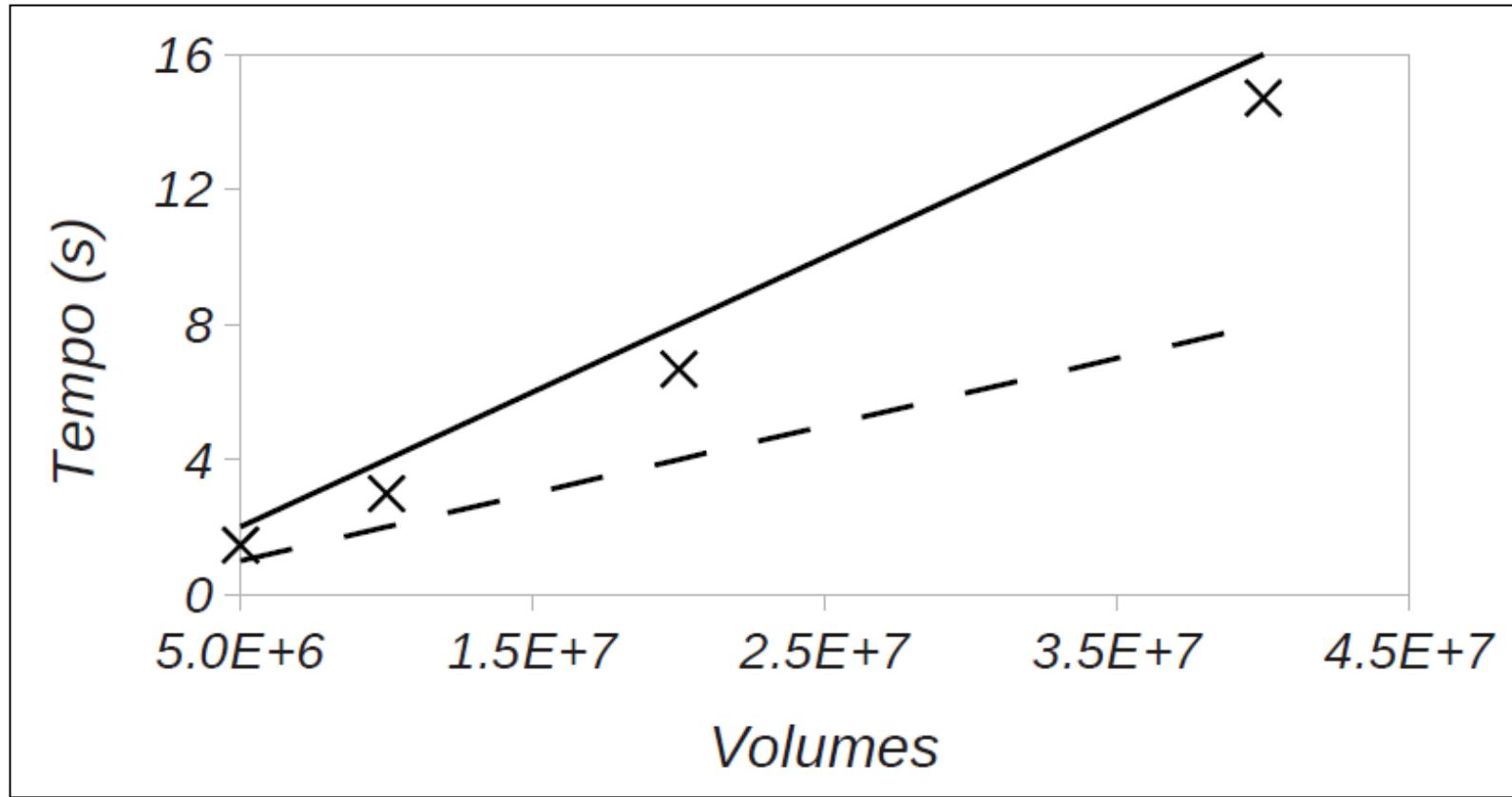


Figura - Tempo de adição de volumes ou partículas na *Hash Table*. Linha contínua, limite superior $O(n)$, e linha tracejada, limite inferior $\Omega(n)$.

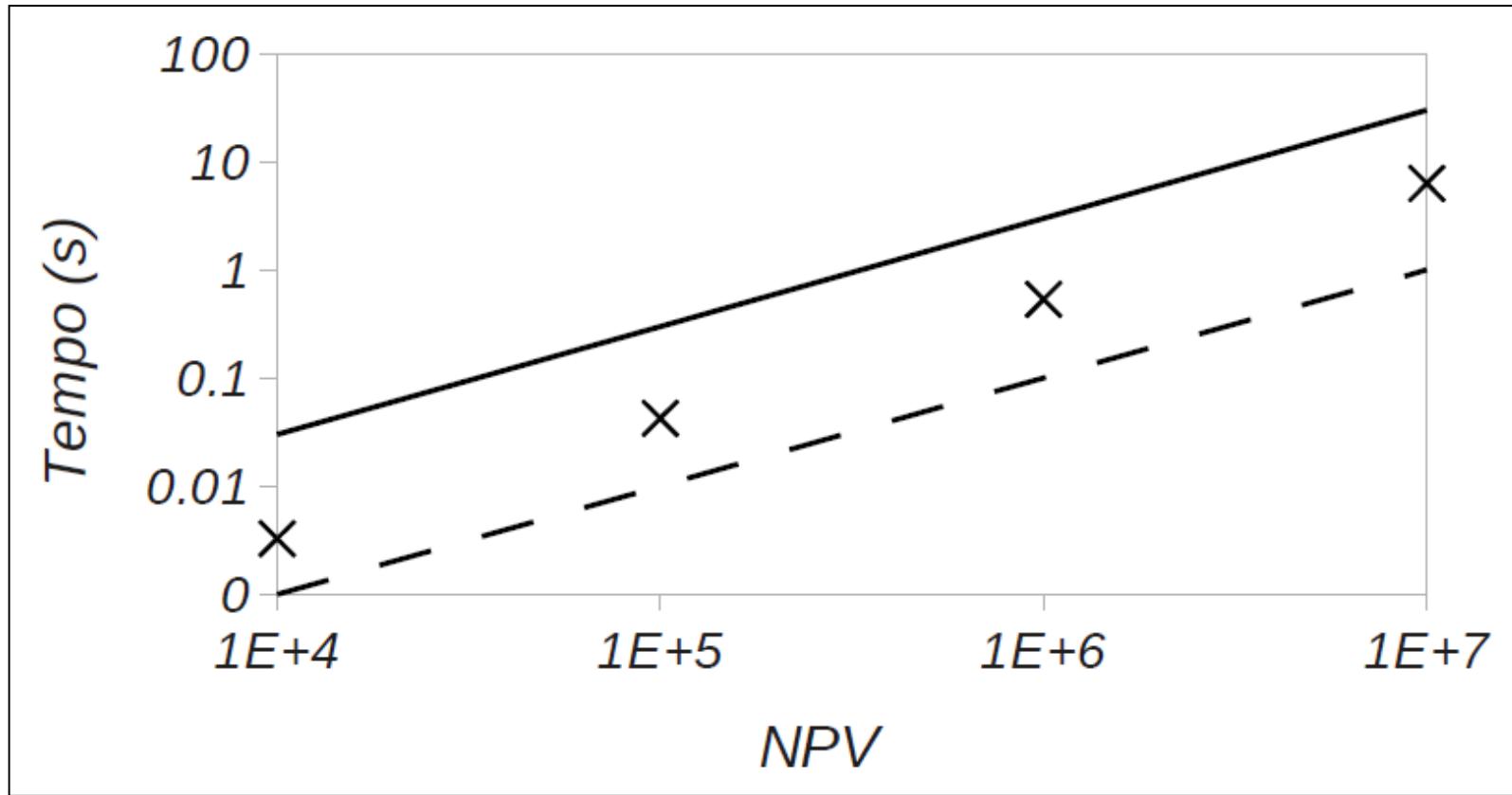


Figura - Tempo de movimentação de partículas entre volumes eulerianos. Linha contínua, limite superior $O(n)$, e linha tracejada, limite inferior $\Omega(n)$.

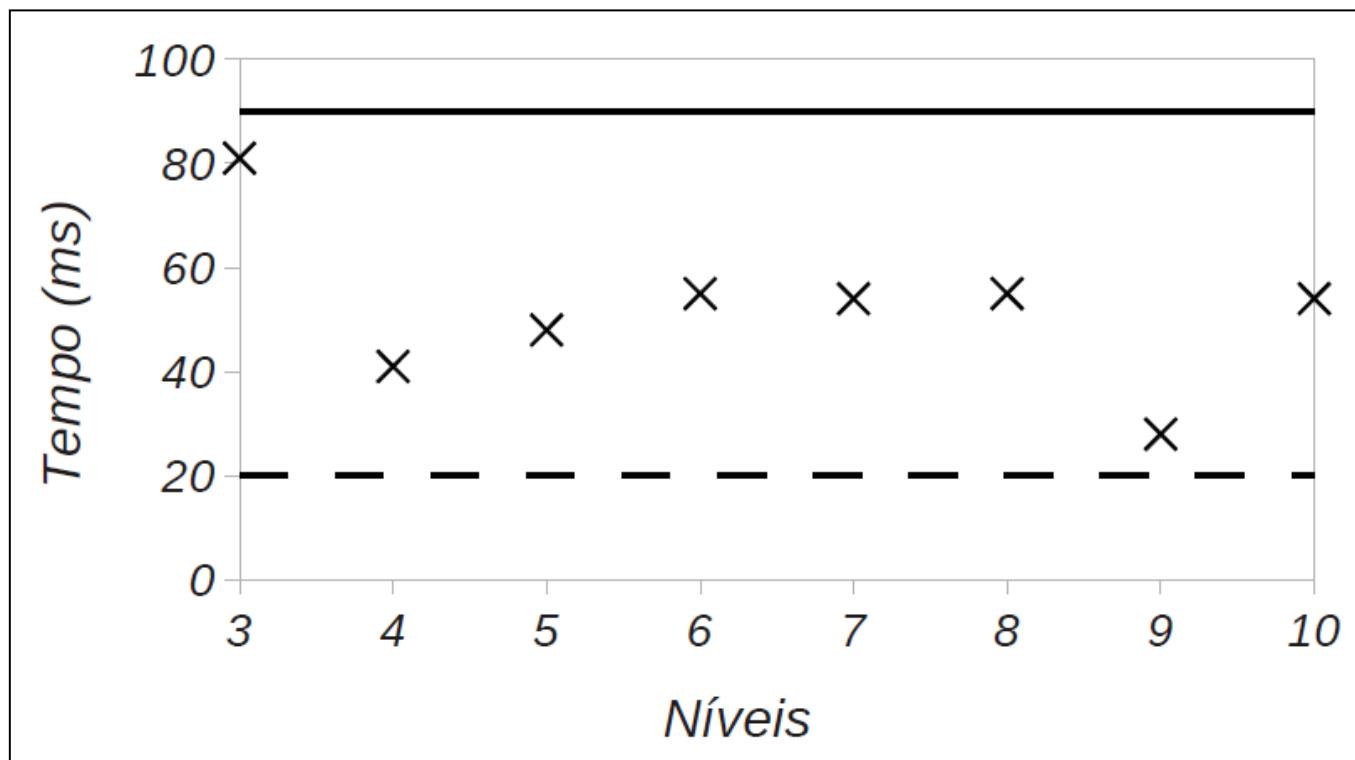
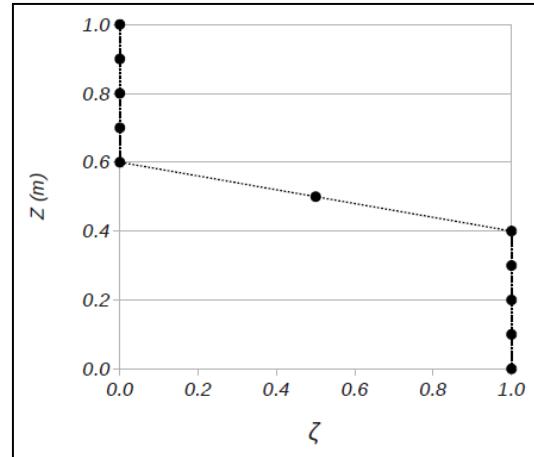
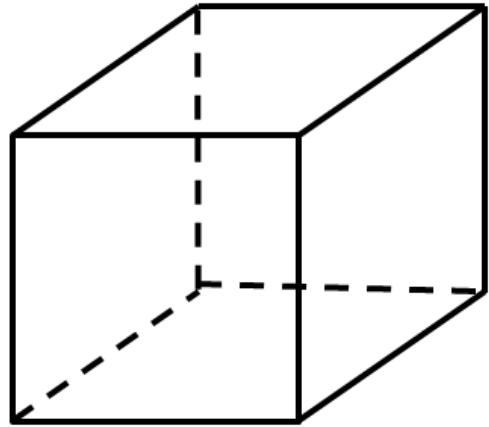


Figura – Tempo do Algoritmo de Busca *Multigrid / Multinível*.

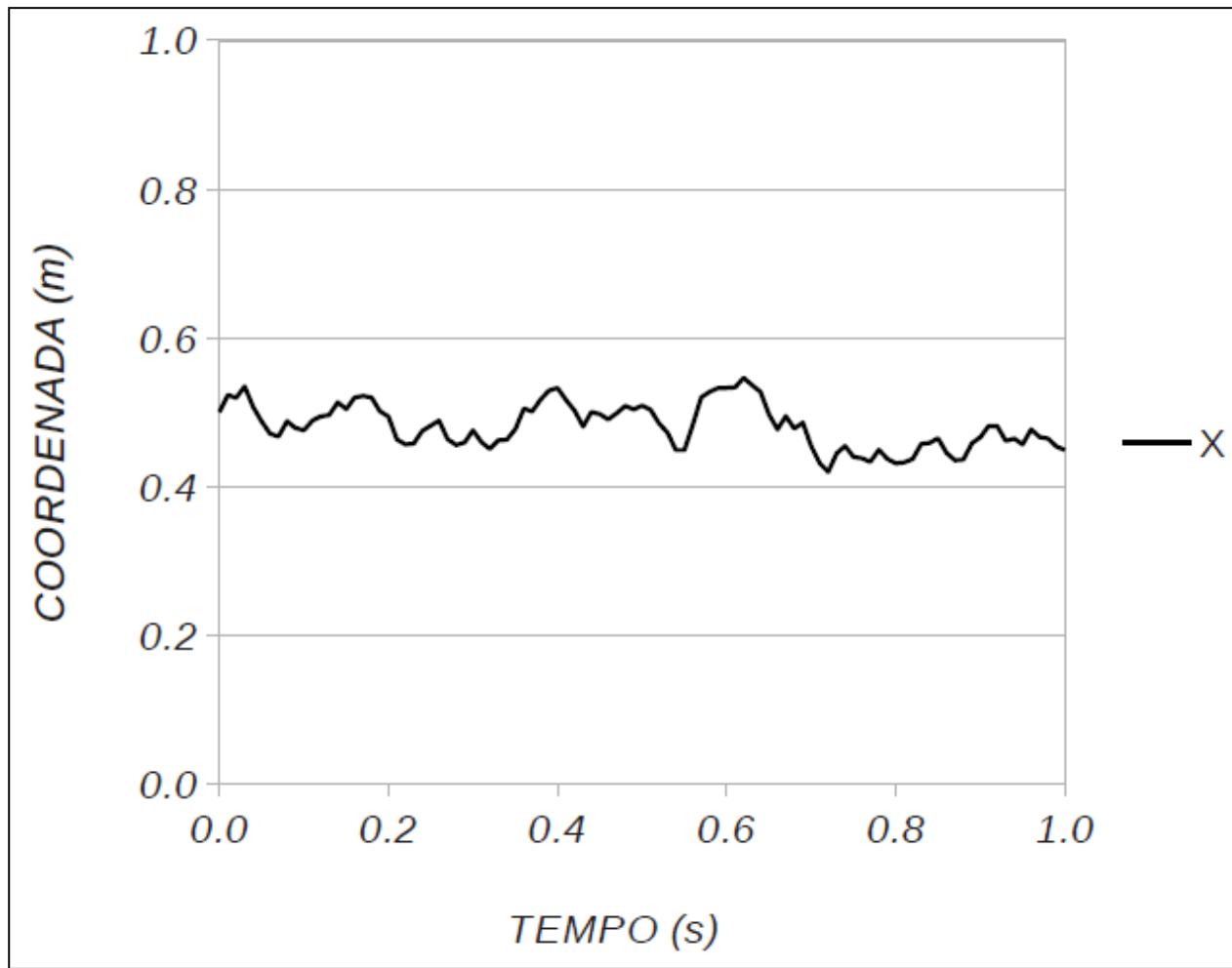


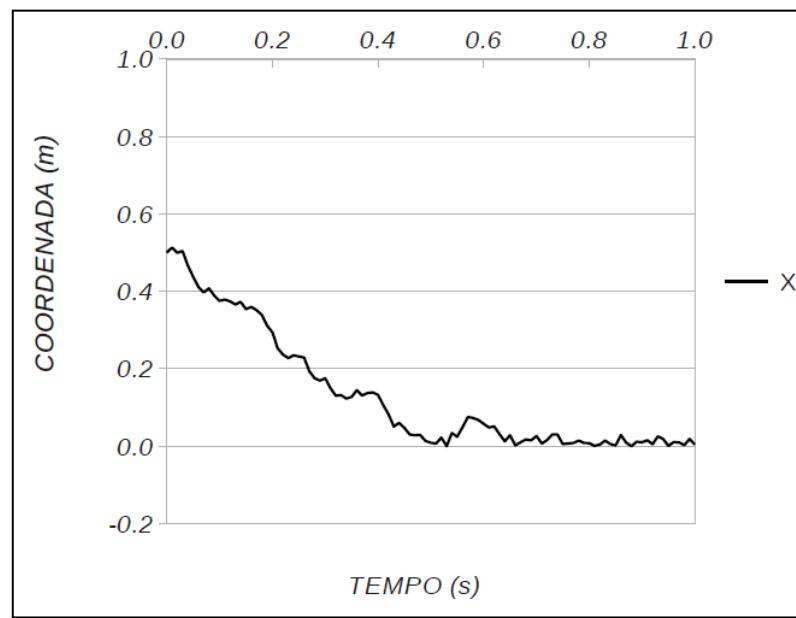
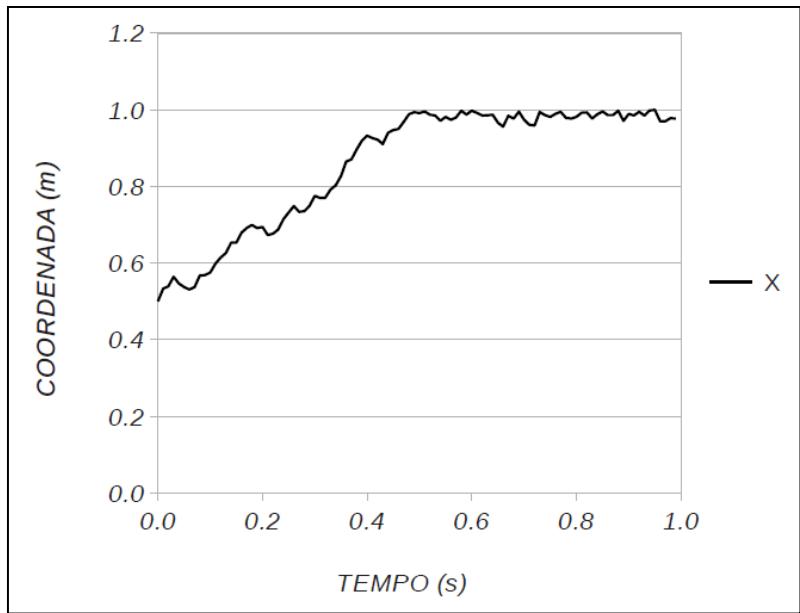
$$dX = [\langle u \rangle(x, t) + \nabla \Gamma_T(x, t)] \cdot dt + [2 \cdot \Gamma_T(x, t)]^{1/2} \cdot dW$$

$$\frac{d\phi}{dt} = S(\phi) - [\Omega_m(\phi - \langle \phi \rangle)]$$

“Note that the IEM model contains no spatial structure due to the assumption that the vessel is well macromixed.”

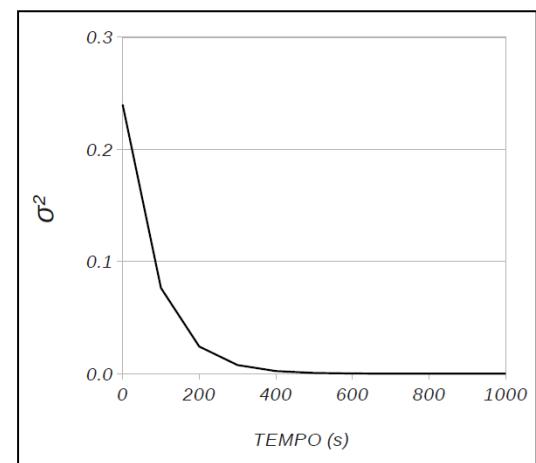
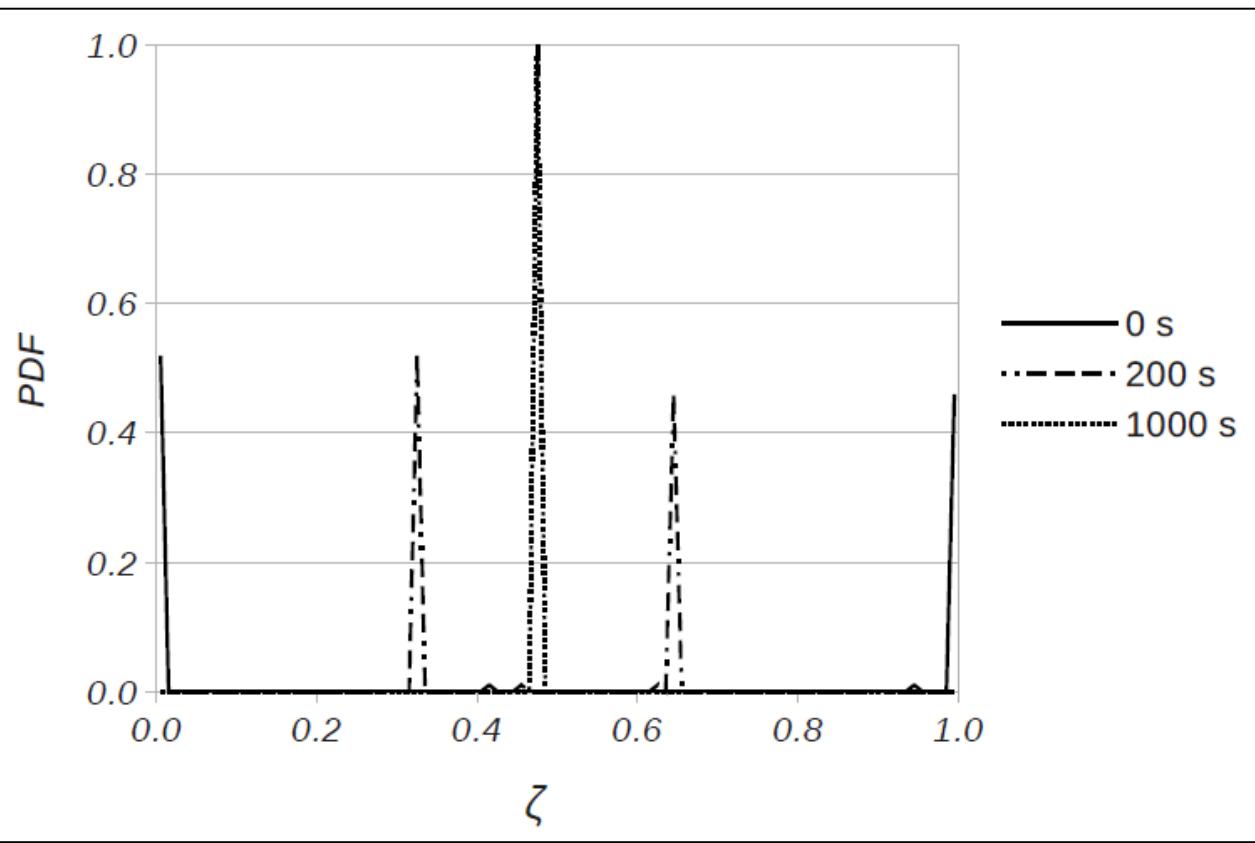
R. O. Fox



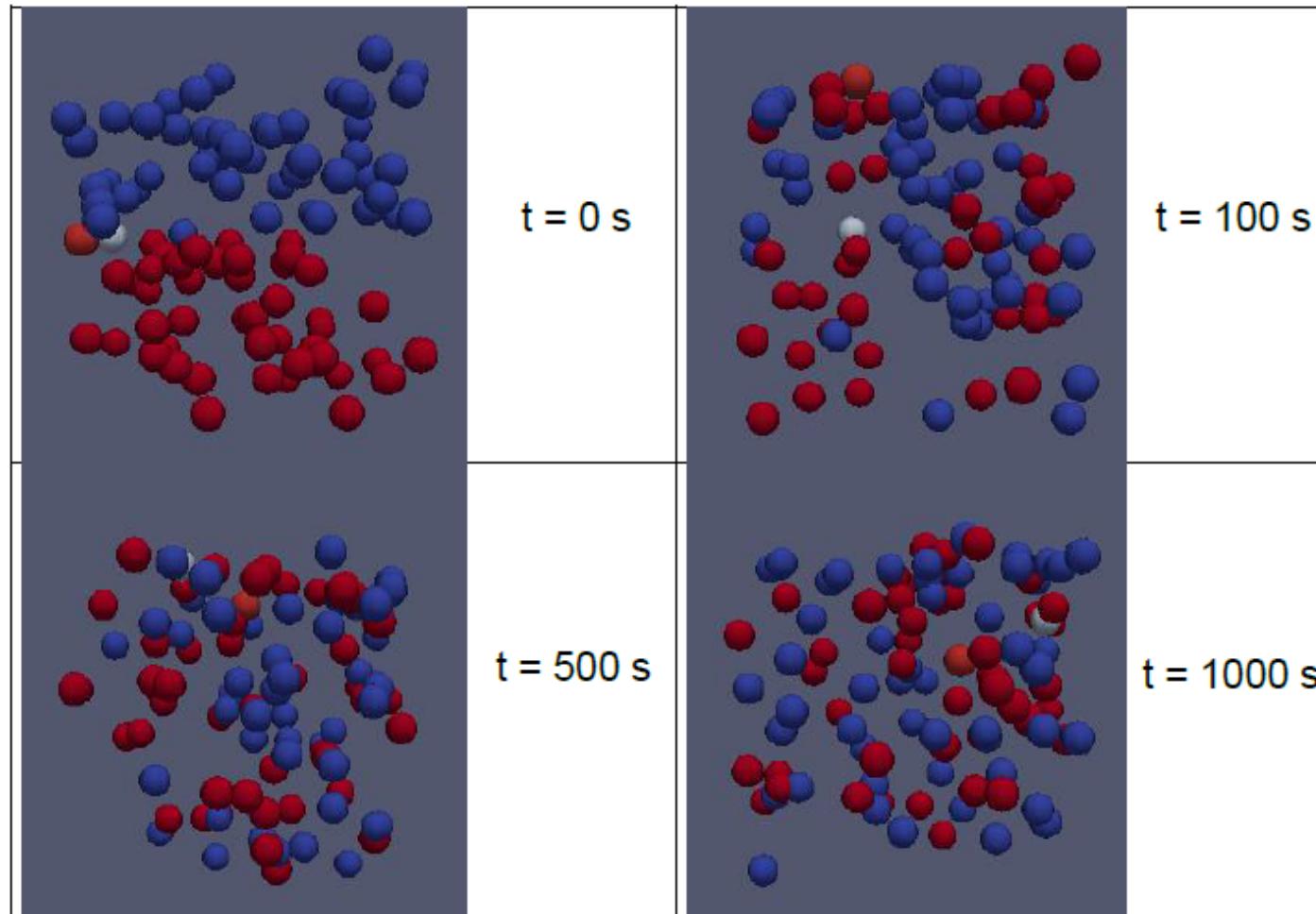


Dados:

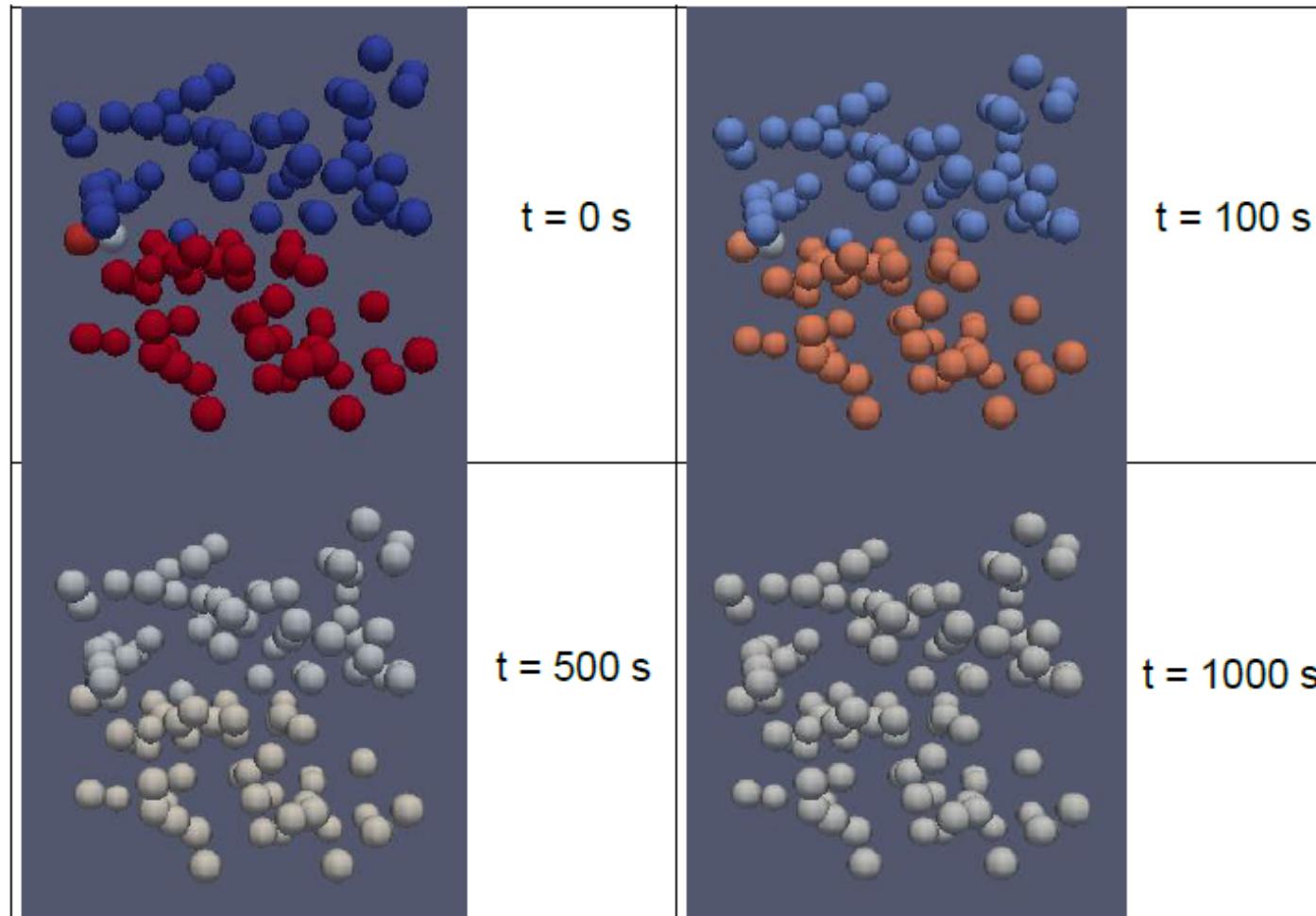
Número de partículas:	100	
Número de intervalos (<i>pdf</i>):	100	
Tempo final:	1000	s
Passo temporal:	0.1	s
Viscosidade cinemática:	$2.0 \cdot 10^{-3}$	m ² /s
Sc	0.7	
Ω_m	2.0	
ζ_1	0.0	
ζ_2	1.0	
Comprimento de mistura	0.01	m
Ponto de mistura	0.5	m



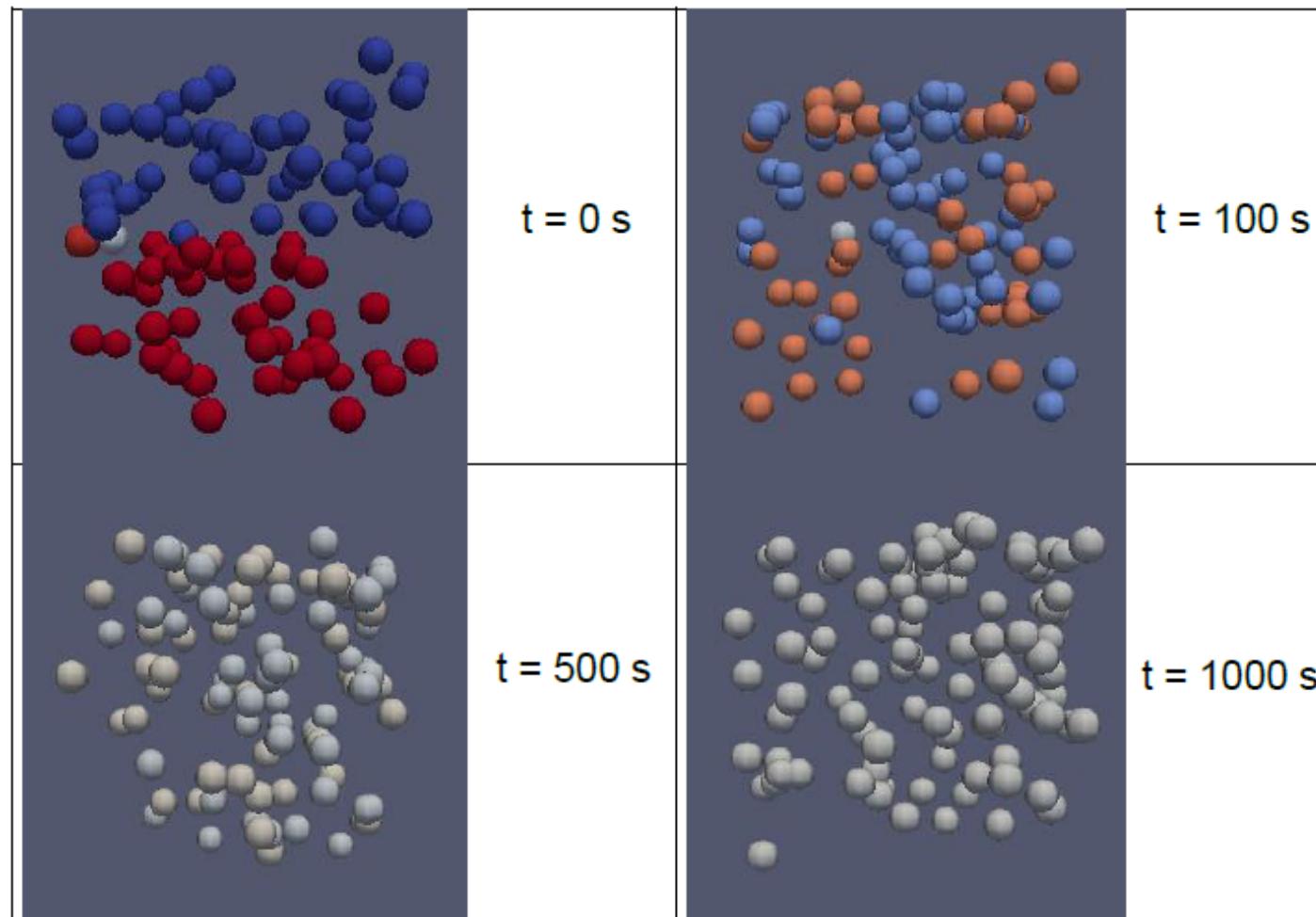
Espaço Físico



Espaço de Composição



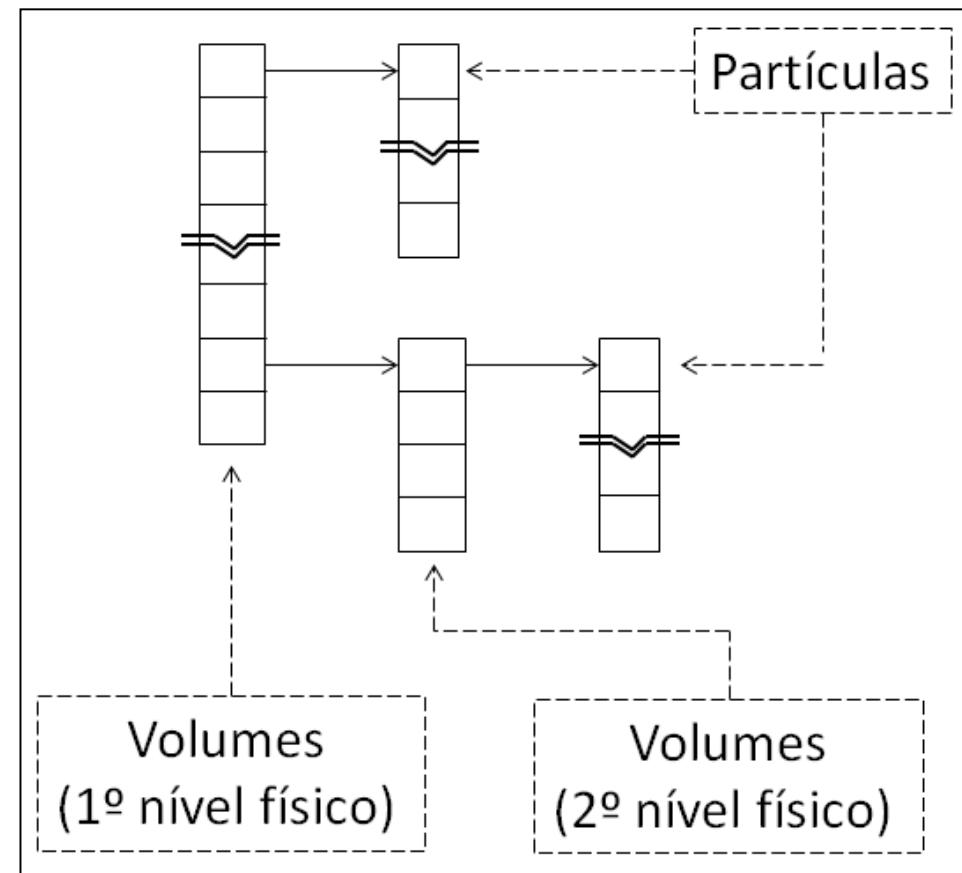
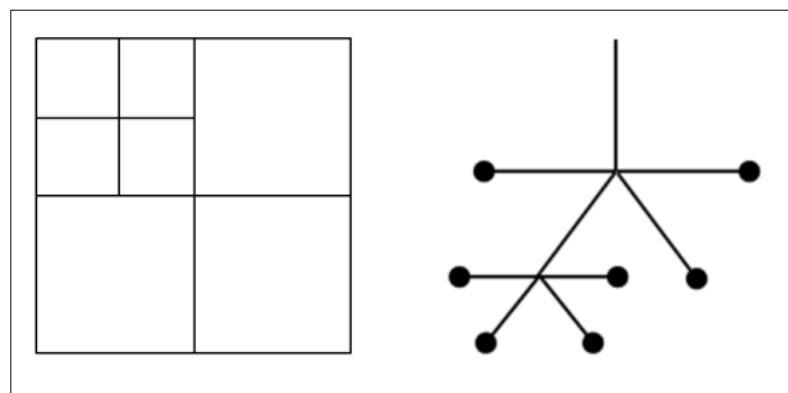
Espaço Físico e de Composição

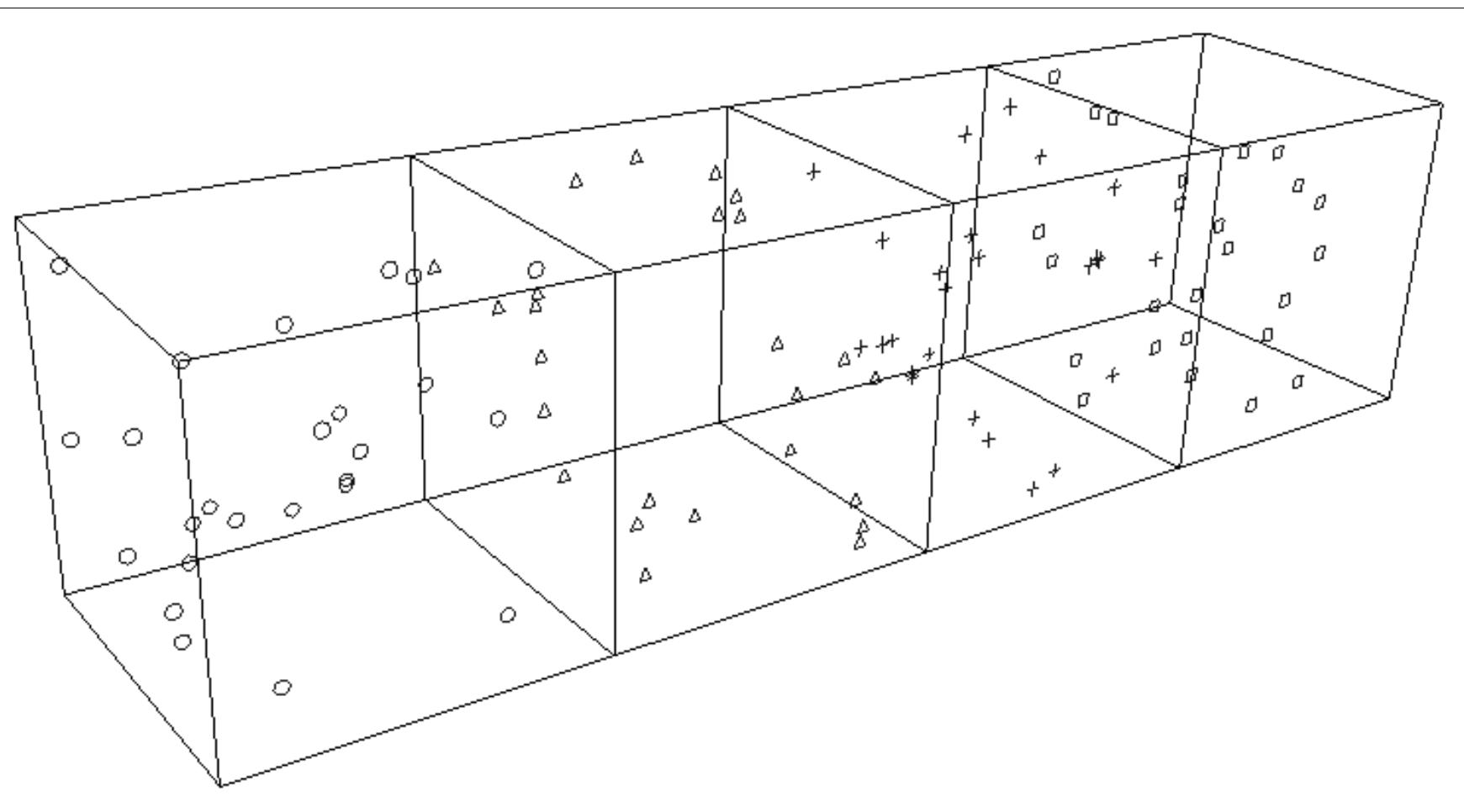


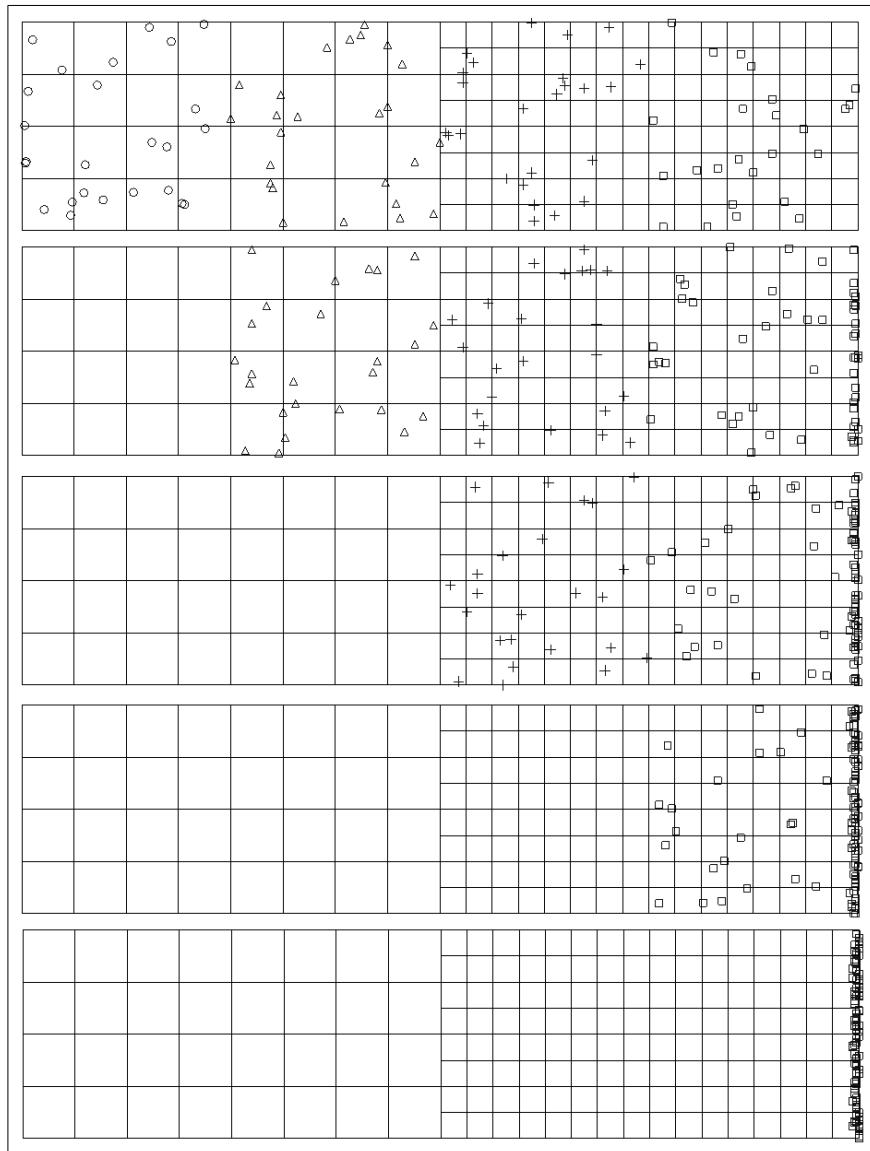
MODELO FÍSICO

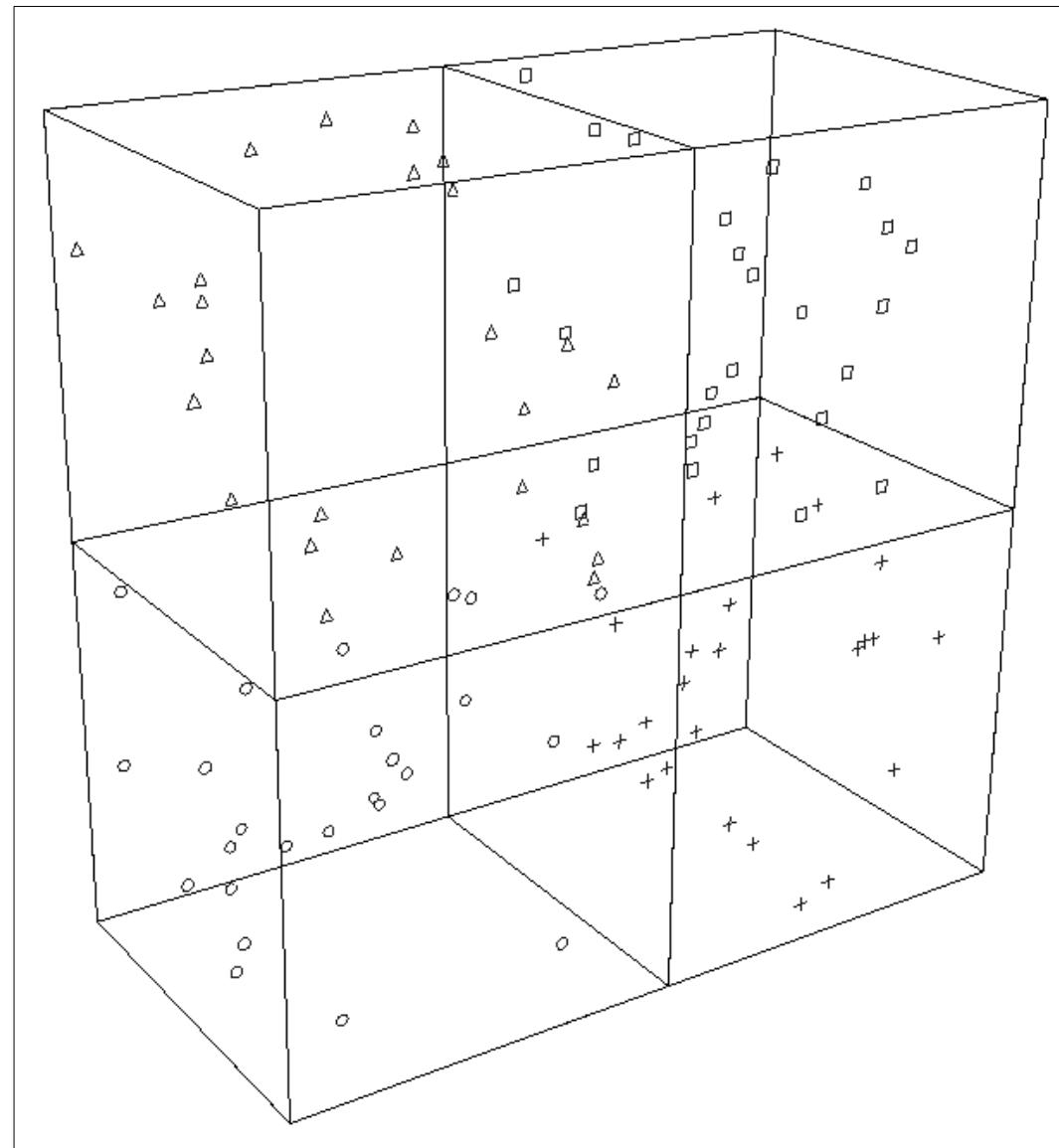
MODELO MATEMÁTICO / NUMÉRICO

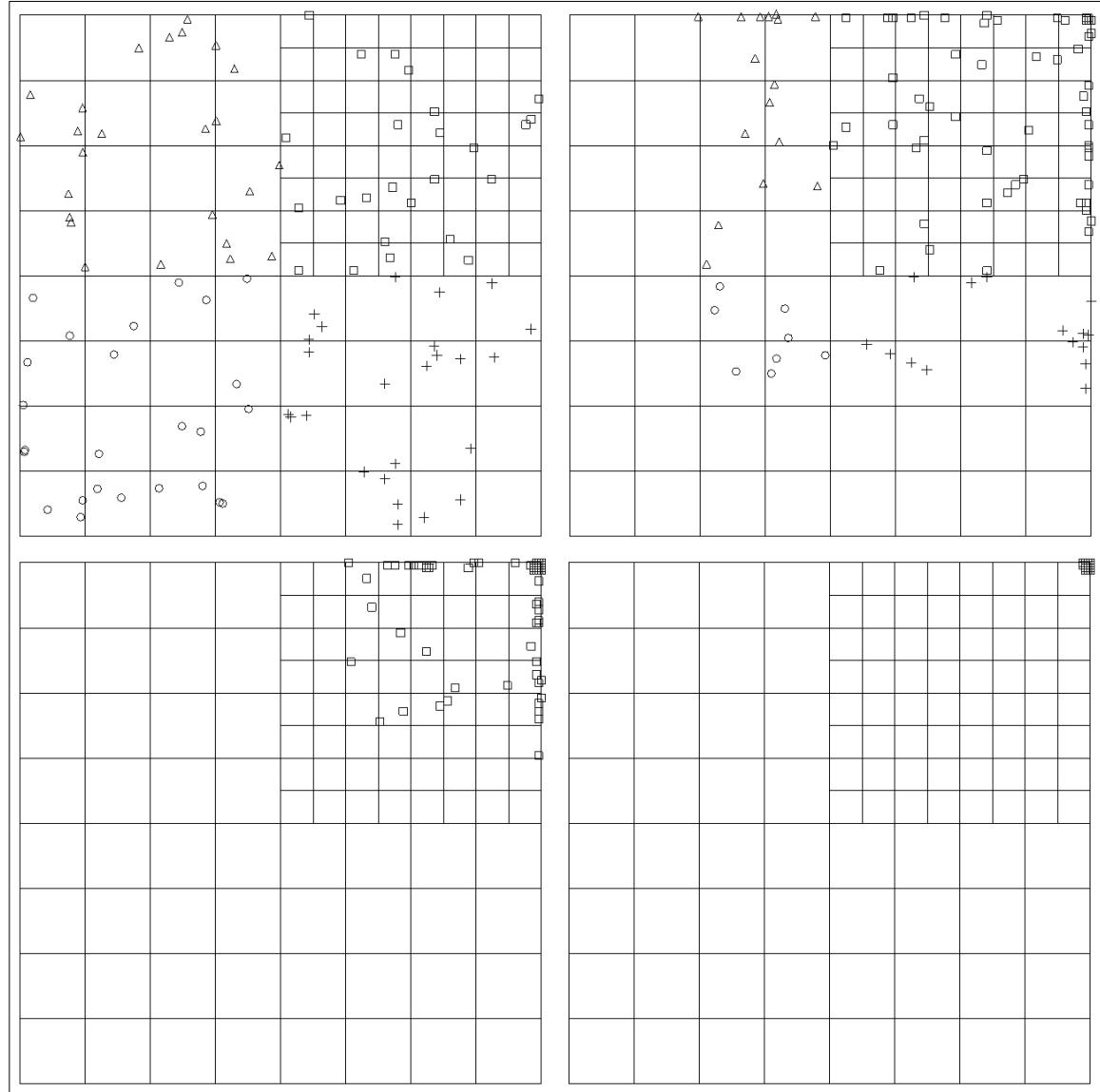
MODELO COMPUTACIONAL

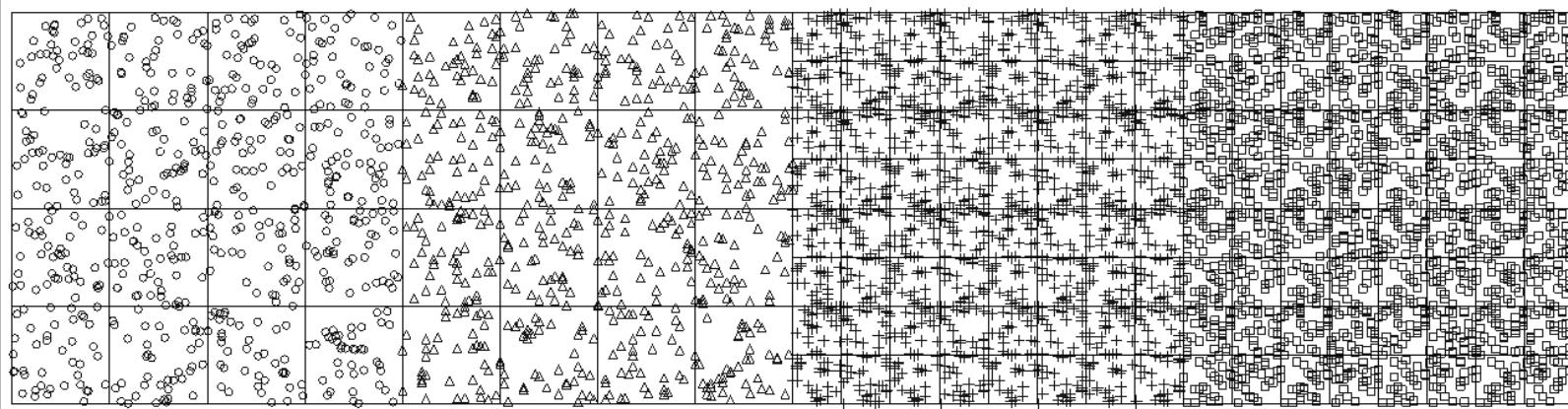
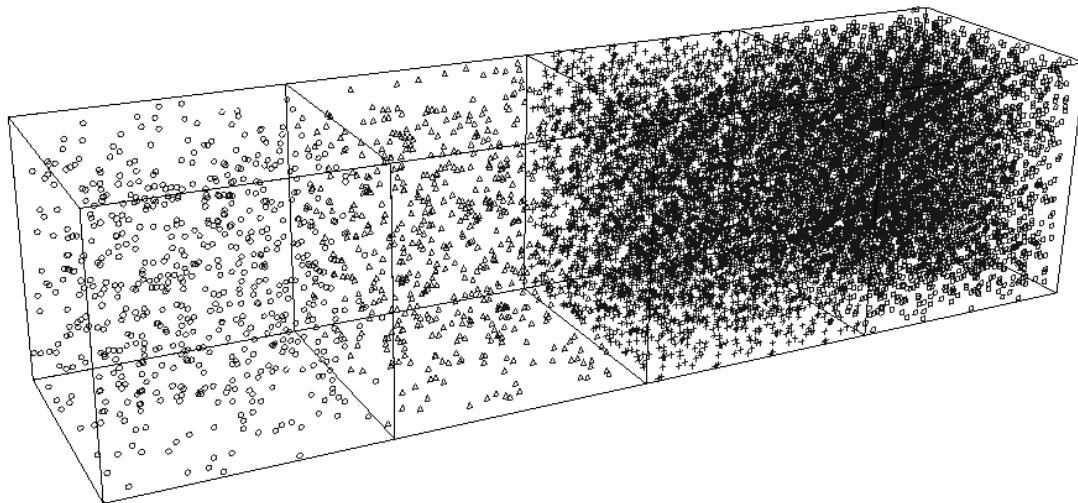


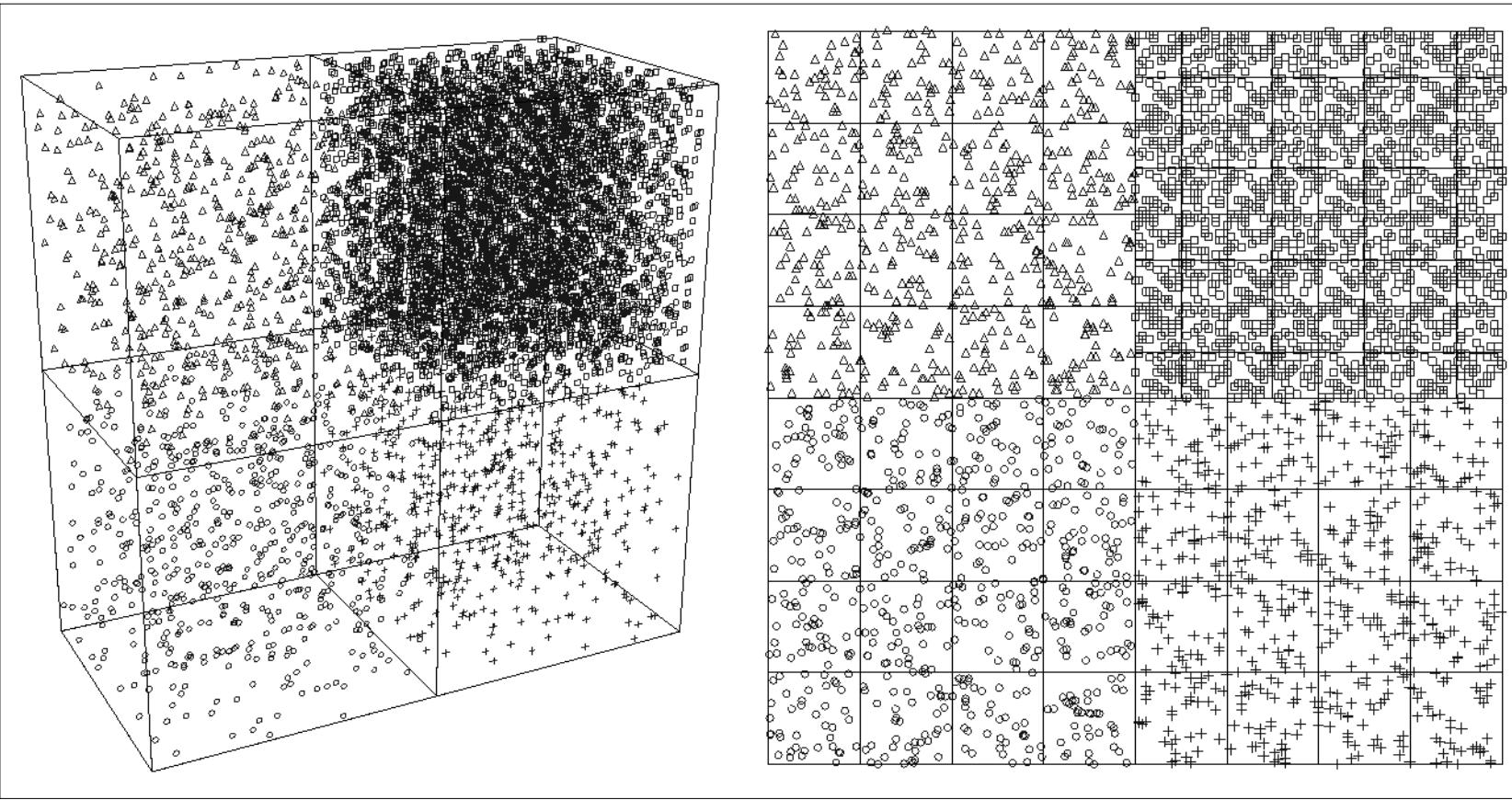












“Quem examina cada questão com cuidado prospera, e feliz é aquele que confia no Senhor” Pv 16.20

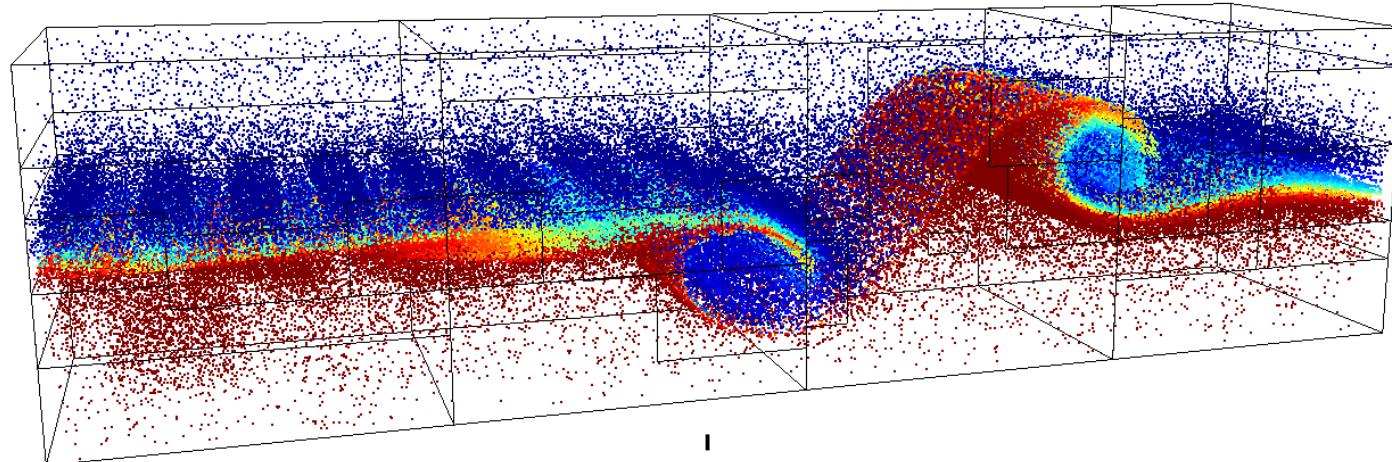
Método híbrido LES / FDF em malha adaptativa, bloco-estruturada

O CONDIÇÕES DE CONTORNO

O EQUIVALÊNCIA

O DIFUSIVIDADE CINEMÁTICA

O CLONAGEM



O ESTATÍSTICAS

O SUPRESSÃO

O VARIÁVEIS - HDF5

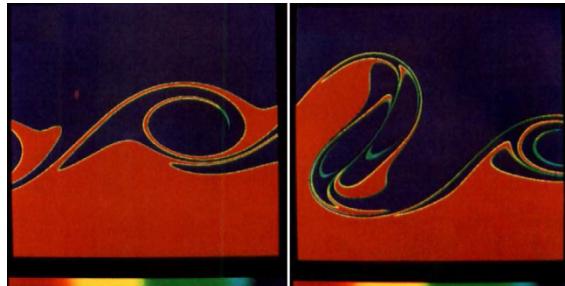
O FECHAMENTO SDE

TURBULÊNCIA - REYNOLDS (1883)

CO₂ JET - LANDIS; SHAPIRO (1951)

LES - SMAGORINSKY (1963)

MISTURA - NAGATA (1975)

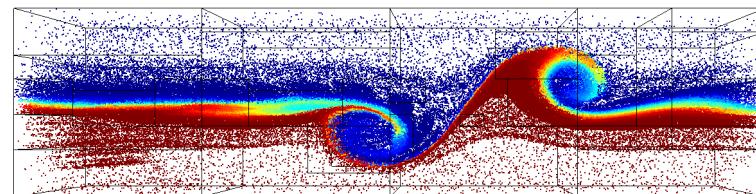


KOOCHESFAHANI; DIMOTAKIS (1986)

MÉTODO PDF - POPE (1985)

MÉTODO FDF - GIVI (1989)

LAGRANGIAN MC (1998)



DENSIDADE VARIÁVEL (1999)

GRUPOS DE PESQUISA (2009)

MFLAB - VEDOVOTO (2011)

AMR3D - FERREIRA (2014)

