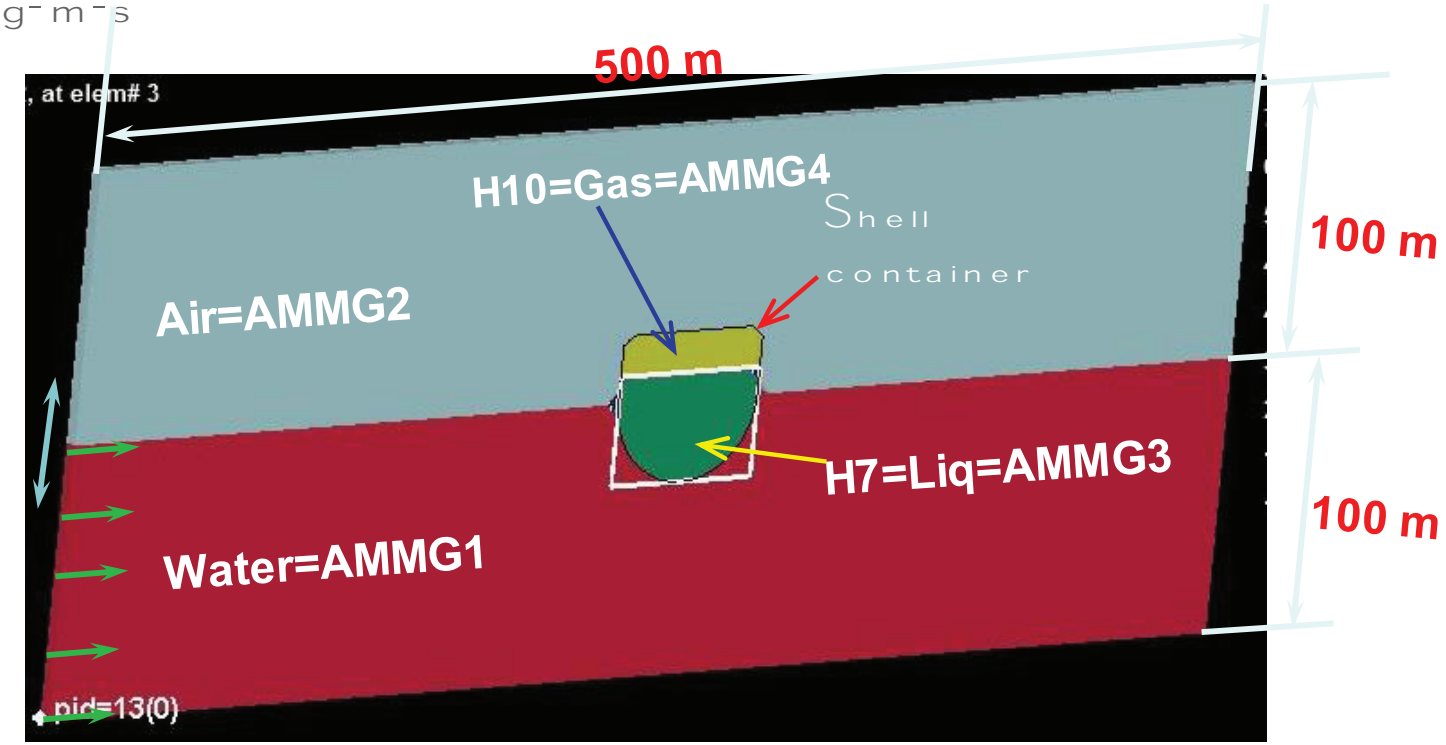
Application: Floating Ship – Model Description

- Water and air domains are initialized with hydrostatic pressure.
- A "ship" (closed shell container) containing a liquid and a gas floats via buoyancy force on the surface of the water.
- Then artificial wave is generated (LHS) and the wave interacts with the external surface of the ship while the internal fluids interact with the internal surface of the ship.
- Unit Kg-m-s



Application: Floating Ship – Model Setup 1

*ALE_STRUCTURED_MESH					
MSHID	PID	NBID	EBID		
1	11	300001	300001		
CPIDX	CPIDY	CPIDZ	NID0	LCSID	
1001	1002	1003			

MSHID: Mesh ID (for future use)

PID: Part ID assigned to the mesh
NO NEED to define *PART card

NBID: Starting Node ID

EBID: Starting Element ID

NID0: Origin Node ID

LCSID: Local Coordinate System ID

*ALE_STRUCTURED_MESH_CONTROL_POINTS			
1001			
1		0.	
101		500.	

*ALE_STRUCTURED_MESH_CONTROL_POINTS			
1002			
1		0.	
41		200.	

*ALE_STRUCTURED_MESH_CONTROL_POINTS			
1003			
1		0.	
2		5.	

Application: Floating Ship – Model Setup 2

*ALE_MULTI-MATERIAL_GROUP	
PID	PTYPE
1	1
3	1
7	1
10	1

1 to 1

*PART				
PID	SECID	MID	EOSID	HGID
1	1	1	1	1
3	1	3	3	1
7	1	7	7	1
10	1	3	3	1

PID	MATERIAL	AMMG
1	Water	1
3	Air	2
7	Fluid inside	3
10	Air inside	4

- *SECTION should always be 11. Same SECID OK.
- *HOURGLASS form and coefficient should always be 1 and 1.0e-6. Same HGID OK.
- PIDs not used elsewhere. Only to be put into *ALE_MULTI-MATERIAL_GROUP card.

Application: Floating Ship – Model Setup 3

*INITIAL_VOLUME_FRACTION_GEOMETRY							
SID	IDTYP	BAMMG					
11	1	1					
TYPE	FILLOPT	FAMMG				“3 = Plane”	
3	0	2					
X0	Y0	Z0	XCOS	YCOS	ZCOS		
10.0	100.0	0.0	0.0	0.0	1.0		
TYPE	FILLOPT	FAMMG				“1 = PART/PSET”	
1	0	3					
SETID	SETTYP	NORMD	XOFF				
5	1						
TYPE	FILLOPT	FAMMG				“1 = PART/PSET”	
1	0	4					
SETID	SETTYP	NORMD	XOFF				
6	1						

1. All to “water”; 2. Above the plane to “air”; 3. Inside PART 5 to “fluid inside”; 4. Inside PART 6 to “air inside”

Application: Floating Ship – Hydrostatic Pressure 1

*ALE_AMBIENT_HYDROSTATIC

SID	STYPE	VECID	GRAV	PBASE
101	2	1	9.80665	101325.
NID	MMGB			
20002	2			
20001	1			

*ALE_AMBIENT_HYDROSTATIC

SID	STYPE	VECID	GRAV	PBASE
102	2	1	9.80665	101325.
NID	MMGB			
20002	2			
20000	1			

*BOUNDARY_PRESCRIBED_MOTION_NODE

SID	DOF	VAD	LCID
20001	2	2	6

*DEFINE_CURVE

LCID	SIDR	SFA	SFO
6			35.
TIME		Y=SIN(T)	
0.0		0.0	
...		...	
4.5		1.0	
...		...	
50.0		0.0	

Apply hydrostatic pressure on a collection of solid elements at the mesh boundary. A moving node will create waves.

Application: Floating Ship – Hydrostatic Pressure 2

*SET_SOLID_GENERAL							
SID					Two layers of elements at –X face		
101							
OPTION	MSHID	XMIN	XMAX	YMIN	YMAX	ZMIN	ZMAX
SALECPT	1	1	3	1	41	1	2

*SET_SOLID_GENERAL							
SID					Two layers of elements at X face		
102							
OPTION	MSHID	XMIN	XMAX	YMIN	YMAX	ZMIN	ZMAX
SALECPT	1	99	101	1	41	1	2

*BOUNDARY_SPC_NODE				
SID	CID	DOFX	DOFY	DOFZ
20000	0	1	1	1
20002	0	1	1	1

*LOAD_BODY_Y	
LCID	SF
1	9.80665

Application: Floating Ship – Hydrostatic Pressure 3

*INITIAL_HYDROSTATIC_ALE				
SID	STYPE	VECID	GRAV	PBASE
1	2	1	9.80665	101325.
NID	MMGB			
20002	2			
30500	4			
20164	3			
20001	1			

To apply initial hydrostatic pressure on all the fluids inside the S-ALE mesh

*SET_SOLID_GENERAL							
SID					Two layers of elements at X face		
1							
OPTION	MSHID	XMIN	XMAX	YMIN	YMAX	ZMIN	ZMAX
SALECPT	1	1	101	1	41	1	2

Application: Floating Ship – Boundary Condition 1

All ALE nodes constrained at Z direction

*BOUNDARY_SPC_SET							
NSID	CID	DOFX	DOFY	DOFZ	DOFRX	DOFRY	DOFRZ
1				1			

-Y surface nodes constrained at all directions

*BOUNDARY_SPC_SET							
NSID	CID	DOFX	DOFY	DOFZ	DOFRX	DOFRY	DOFRZ
2		1	1	1			

3 layers of nodes at –X face with a prescribed X velocity

*BOUNDARY_PRESCRIBED_MOTION_SET							
NSID	DOF	VAD	LCID				
4	1	0	3				

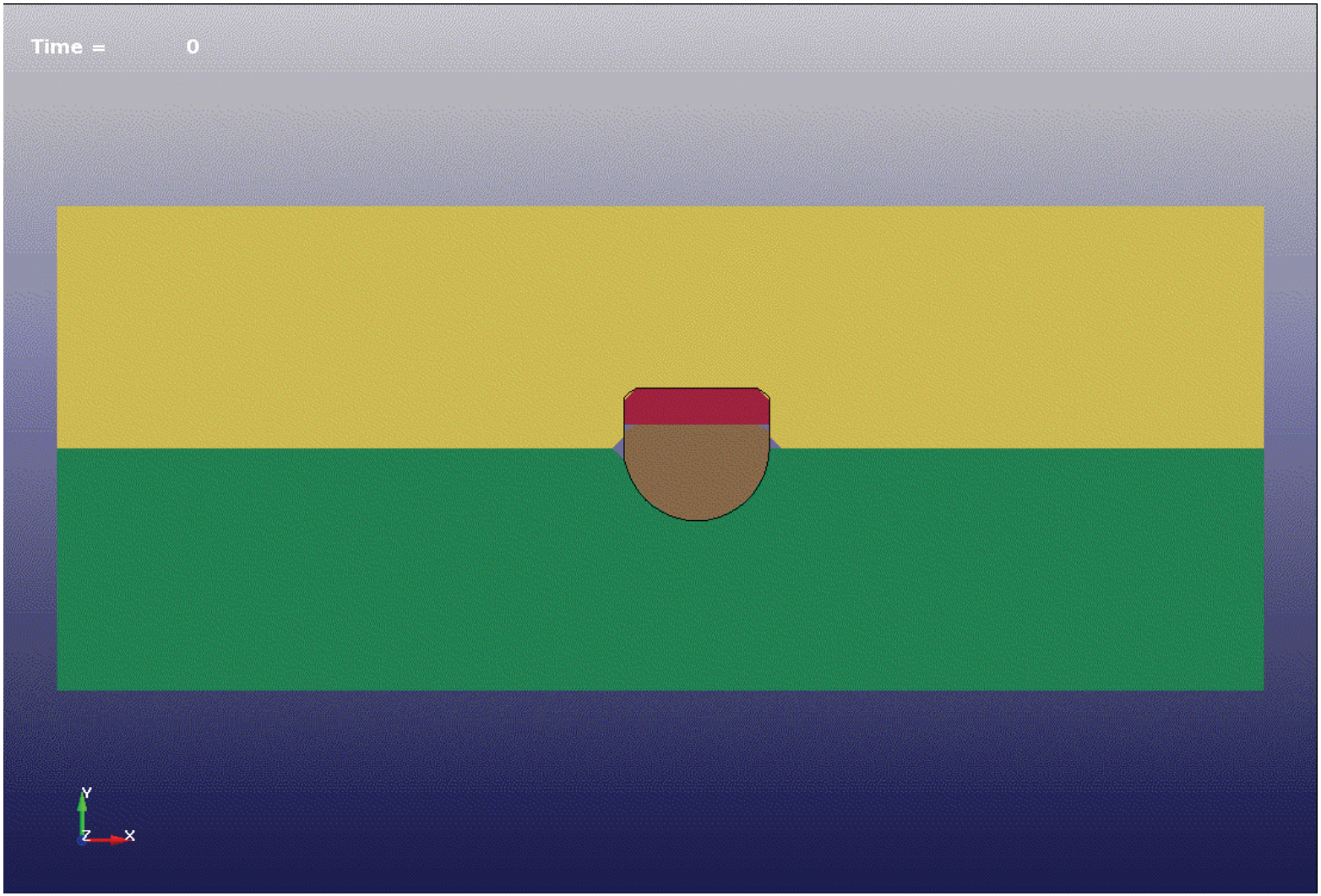
Application: Floating Ship – Boundary Condition 2

*SET_NODE_GENERAL							
SID					All Nodes of S-ALE mesh		
1							
OPTION	MSHID	XMIN	XMAX	YMIN	YMAX	ZMIN	ZMAX
SALECPT	1	1	101	1	41	1	2

*SET_NODE_GENERAL							
SID					-Y face Nodes		
2							
OPTION	MSHID	XMIN	XMAX	YMIN	YMAX	ZMIN	ZMAX
SALEFAC	1			1			

*SET_NODE_GENERAL							
SID					3 layers of -X face Nodes		
4							
OPTION	MSHID	XMIN	XMAX	YMIN	YMAX	ZMIN	ZMAX
SALECPT	1	1	3	1	41	1	2

Application: Floating Ship – Result



S-ALE : 699s; ALE: 806s 1 CPU LSDYNA dev.106021 single precision