XimeX ASAP™ : Multi-layer application

An ASAP™ application solves a CFD(Computing Fluid Dynamics) Navier & Stockes system providing a complete field of pressure / velocity / shear 3D maps.

Optionaly a set of particles can be propagaged using pre-computed velocity field to provide quantifying mixing criteria based on statistical analysis.

With the support of top level laboratories

XimeX® hand Ximex-ASAP™ have been developed by the CEMEF (from Mines ParisTech)

Cemef
CENTRE DE MISE EN FORME DES MATERIAUX

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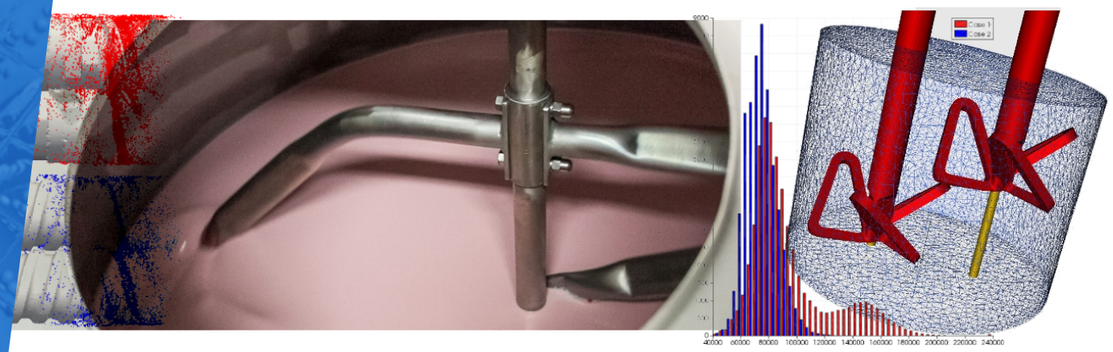
XimeX® Asap™

Control the Process to Control the Product



Your numerical partner for Mixing equipments !

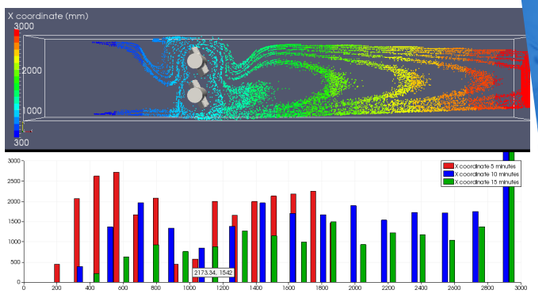
3D numerical simulation in 2020 !

A numerical software is only worth what the physics models are. But to exercise these physics models, the software needs to figure out the environment, the equipment, the tooling, the material … Here comes the « numerics » foundation. More complex equipments means more geometric descriptions , bigger models, and more and more computing requirements. Here then, comes the parallelisation : to split big problems in number of small problems to be solved in parallel.

3D numerical simulation is a matter of software and computers !
What is left to process engineers, to chemists ? Do they have the numerical background to handle such a software ?
Numerical complexity is limiting the dissemination and usage of 3D general purpose software.

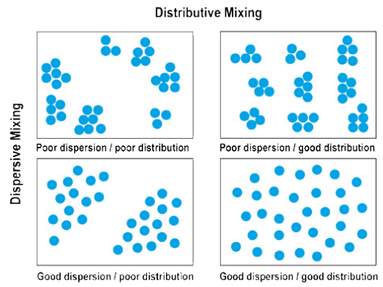
Physics is complex

Physics is representated as models in simulation software. Which model is suitable to elaborate correctly such or such phenomenum ? What is the impact of handling material contact, multiphasic, tribology, mixing, self heating, turbulency. Should we select transient or stationnary simulation ? What about material description ?
Newtonian like material are a virtual and simplified vision of real materials : Which rheology law is more representative ? Why software do provide several ones ?

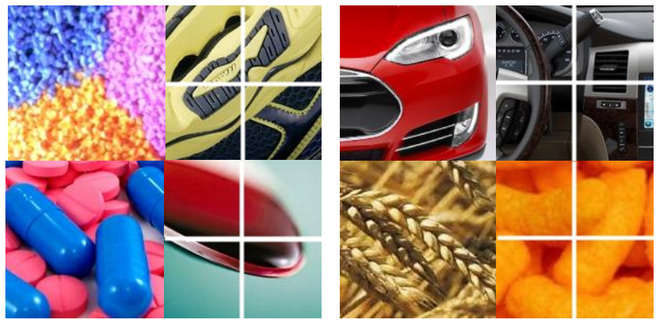


Mixing processes

Mixing processes are either batch or continous equipements designed to maximise 2 or more material mixing being either liquid-liquid or liquid-solid.
Mixing is a qualitatively well known phenomenon. But how to compare the mixing efficiency of 2 equipments or 2 different equipments settings without accessing to quantifying criteria ?



Simulation preparation time : Human ressource is the key !



Not only Production, Support and R&D people need to manage their processes and the physical phenomema taking place.
To use 3D simulation as a **Decision Making** support, the **ASAP™** solution overcomes all un-necessary « numerical meshing / numerical convergence / iterations » issues to focus on the equipment functionnality !

Function	*Model*	*Option*	
Flow modeling **Stokes/Navier-Stokes mechanical model**	Boundary conditions	Imposed Velocity	
		Imposed Pressure	
		No boundary conditions	
	Material characterization	Mechanical behaviour	Newtonian behaviour
			Power law
			Cross law
			Carreau Yasuda law
			Carreau Yasuda law (with threshold)
			Bingham law
			Papanastasiou law
			Herschel Buckley law
		Chemical kinetics	Kamal Sourour law
			Piloyan law
			Isayev law
		Thermics and mechanics coupling	Arrhenius law
			WLF law
			Vogel Fulcher law
		Kinetics and mechanics coupling	Castro & Macosko model
Thermal modeling	Thermal behaviour of immersed domain and boundary conditions	Imposed Flux	
		Imposed Temperature	
		Fourier flux exchange	
Particles tracking	Analysis functions	Residence Time Distribution	
		Erosion model	
		Average stretching	
		Number of transition (through a plan)	
		Cumulated results	Cumulated Strain
			Cumulated Energy
			Cumulated Heat
		Glass Fibers breakage	
Re-Meshing models	Parallel Boundary meshing	Local remeshing for initial conditions tracking	
	Parallel Immersion meshing	Anisotropic resmeshing for parts immersion boundaries tracking	
Meshing model	STL to tetrahedron initial mesh	Delaunay sequential 64b mesh	
Parallelism	Up to 512 cores		

Local analysis focused

Modeling the mixing processes for
- getting indeep details on the mixing phenomena
- optimizing the processes

Quantifying the mixing effiency

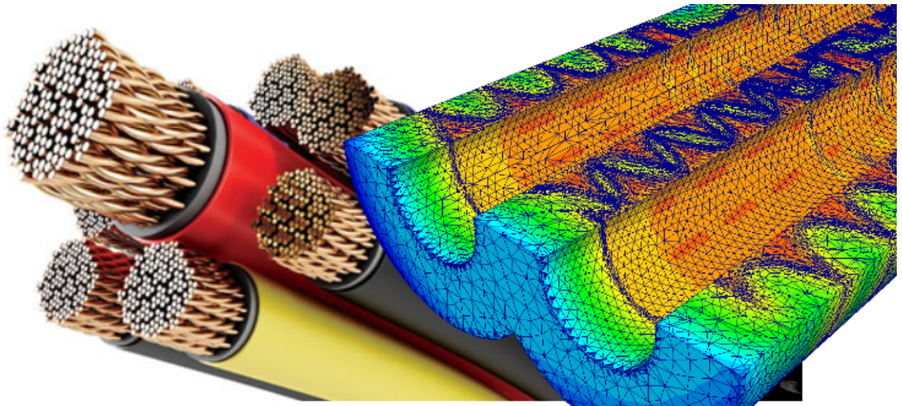
With a particles analysis, XimeX quantifies the mixing efficiency on given zones by identifying dispersive/distributive mixing criteria

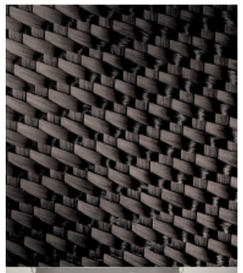
Process optimization at the finger tips

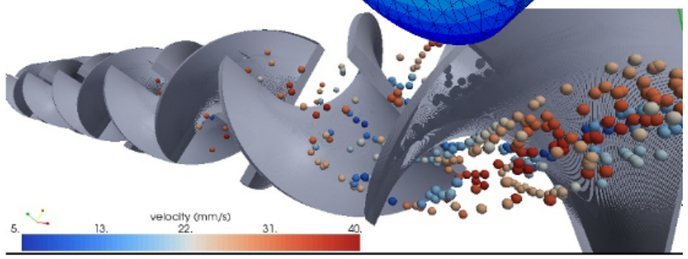
XimeX simulations scan the optimization potentiality of a couple process/products

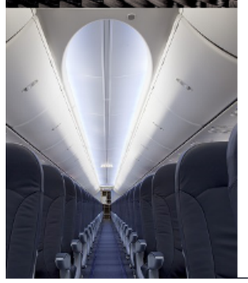
Spreading the simulation benefits

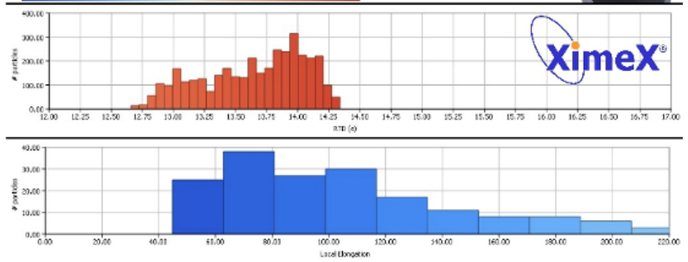
With fully parallelized computation, XimeX provides fast and reliable results for spreading the simulation benefits in a glance











The ASAP™ approach : your numerical partner !

ASAP™ is designed on the basis of the XimeX Strategic Initiative : a research project dedicated to mixing processes simulation platform, led with a pool of industrials companies and supported by SCC and CEMEF laboratory from French MinesParisTech.

Adjusted Software for Advanced Process

As a different approach where software try to be as generic as possible, ASAP™, on the contrary simplifies the situation : **one ASAP for one machine**, only handling the setting that the real equipment does :

- Can you change the tank of the equipement ? No so do ASAP™. Predefined tank means no meshing issue : it has been fixed since the design of the ASAP™ solution.
- Can you change tooling of the equipment ? Yes ? ASAP™ will do so : but from a predefined set of numerical tooling available from the shelve !
- Do you control rotation speed, temperature ? So will the ASAP™ : only the needed and physical parameters are left available to the user : the one that is use to control on the real equipment.

No meshing to deal with !

Should a numerical model use finite volume, finite elements (FEM) with such or such elements (tetrahedrons, heaxhedrons etc ...) this is a matter of numerical simulation specialists. XimeX incorporates a Simple yet efficient FEM Tetrahedrons as a single mesh domain together with a level set + immersion technique which allows to incorporate any geometry attached to any kinematics. In the ASAP™ context, the user has nothing to do with meshing : **it is all there, and is all set** : just use the « 5 parameters / 5 Minutes » technology and get ready to launch a case in minutes !

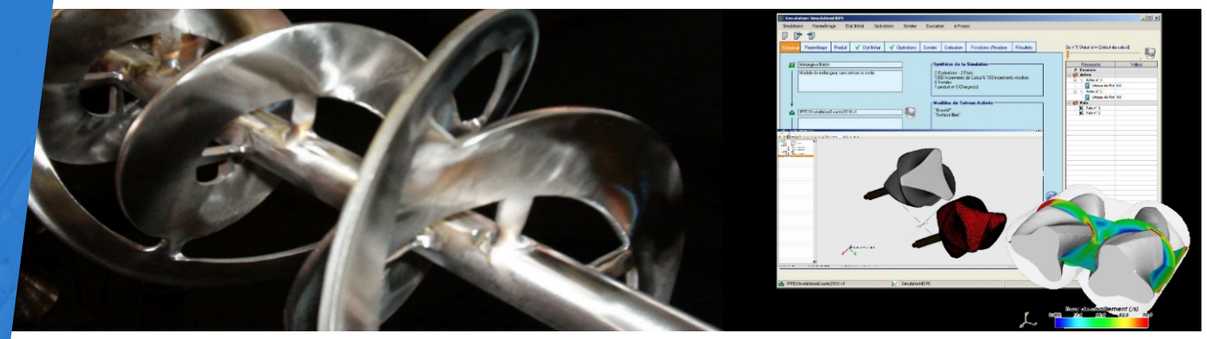
No training to deal with !

The « 5 parameters / 5 Minutes » technology is so simple that even no training is required ! You know about your equipement ? So you know how to operate it twin numerical companion !

No maintenance fees to deal with !

Since the usage is so simple, SCC does not even ask for annual maintenances fees. After an initial period after the delivery of your ASAP™ product : no tricks, no problem !

Should the equipement evolve, and another equipment be bought, ask SCC to design and deliver a new ASAP™ twin numerical companion to operate in relation to you new equipment.



Industrial applications

XimeX is a R&D platform developed in the frame of a collaborative project with the support of different key manufacturing industries from many application ranges.
Based on this plaftorm, SCC now proposes a new approach for making 3D HPC CFD computing available to users : the **ASAP™** solution. Here below an extract of communications published during the initial R&D project :

Melt and Extrusion

Title	*Authors*	*Year*	*Journal*
Numerical simulation of paste extrusion process	T. Coupez, E. Foudrinier, B. Vergnes, R. Valette	2006	7th world congress on Computational Mechanics, Los Angeles
Techniques d'interaction fluide structure et théories cinétiques pour la simulation des procédés de mélange des polymères	R. Valette, B. Vergnes, T. Coupez	2007	18eme congrés français de mécanique, Grenoble
Etude numérique et expérimentale du procédé d'extrusion de pâtes argileuses	E. Foudrinier	2007	Thèse (french)
A full 3D simulation for twin screw extrusion based on an immersion domain method. Application to mixing elements	R. Valette, T. Coupez, B. Vergnes	2008	PPS 24 - Salerne
A Direct 3d Numerical Simulation Code for Extrusion and Mixing Processes	R. Valette, T. Coupez, C. David, B. Vergnes	2009	Intern. Polym. Proc., XXIV, 141-147 (2009) DOI 10.3139/217.2207
A full 3D simulation for twin screw extrusion based on an immersion domain method. Application to mixing elements	Ch. David, A. Durin, R. Valette, B. Vergnes, T. Coupez	2009	Antec 2009 - Chicago

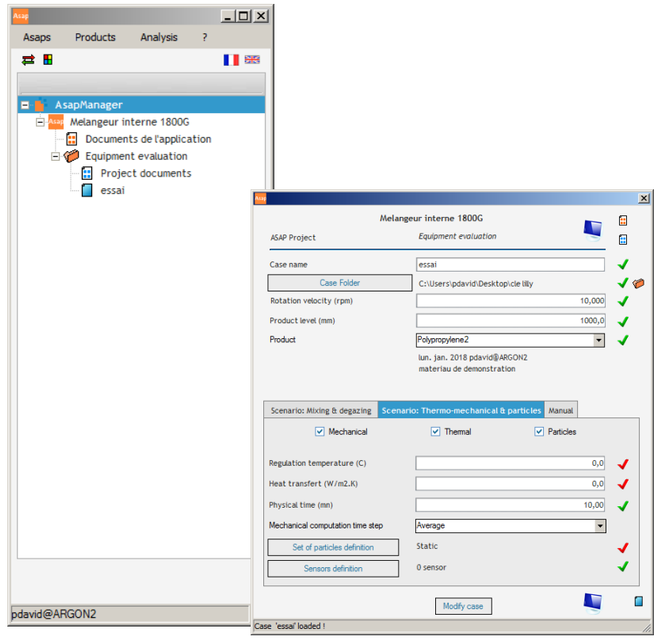
The Mesh immersion technique

Title	*Authors*	*Year*	*Journal*
3D finite elements simulation of twin-screw extrusion process by mesh immersion technique	R. Valette, B. Hiroux, B. Vergnes, T. Coupez	2005	1st international Pyrotechnic Automotive Safety Symposium, Bordeaux
Mesh immersion technique for 3D moving domain calculation and applications to twin-scew extrusion and mixing	R. Valette, B. Vergnes, T. Coupez	2007	22nd annual meeting of the Polymer Processing Society, Yamagata
Mesh immersion technique for moving domain calculation. Application to twin-scew extrusion.	R. Valette, B. Hiroux, B. Vergnes, T. Coupez	2008	8th ESAFORM

Fluid structure interaction

Multiscale simulation of mixing processes using 3D-parallel, fluid structure interaction techniques	R. Valette, B. Vergnes, T. Coupez	2008	11th ESAFORM

XimeX ASAP™ : full packaged solution



XimeX ASAP™ is delivered with an ASAPManager which :
- Install/uninstall ASAP™ applications,
- Manage projects, cases,
- Launch or schedule cases execution
- Provide a shared analysis scheme

The customer tailored ASAP™ application is designed based on customer technical requirements and include :
- Mesh domain(s)
- Tooling CAD file(s)
- The « 5 parameters , 5 minutes » technology with a simplified single Windows® interface window.

Is available for single screw , co-rotating twin-screw, counter-rotating, conical extrusion.
Batch , static mixers, scrappers mixers,

User's Interface modules are available for Windows®, Solver is available on Windows® and Linux platform and support MsMpi or OpenMPI.