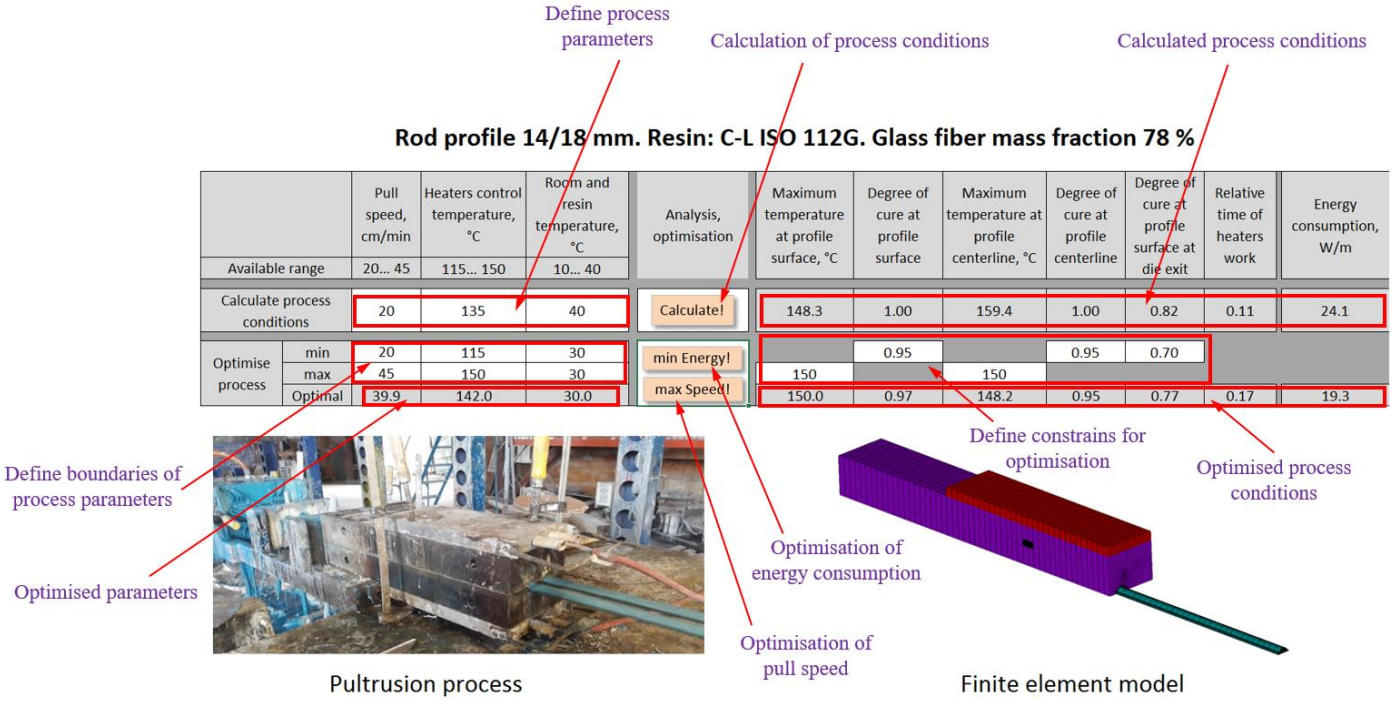
Work stages: Activity 1

Milestone: 2

Milestone name: Optimisation methodology for the conventional putrusion processes

Optimisation methodology based on the planning of experiments and response surface technique has been developed for an improvement of the effectiveness and productivity of conventional pultrusion processes. This non-direct optimisation methodology has been successfully applied for a building of new interactive technological maps for three dies used in industrial shop for a production of the following profiles:

- two rod profiles with ears made of glass fibre TEX4800 and polyester resin C-L ISO 112G,
- thin-walled angle profile made of glass fibre TEX4800 and epoxy resin RESOLTECH 1401+1407+AC140,
- thin-walled rectangular profile made of glass fibre TEX4800 and vinyl ester resin CRYSTIC VE 676-03.



		Pull speed, cm/min	Heaters control temperature, °C	Room and resin temperature, °C	Analysis, optimisation	Maximum temperature at profile surface, °C	Degree of cure at profile surface	Maximum temperature at profile centerline, °C	Degree of cure at profile centerline	Degree of cure at profile surface at die exit	Relative time of heaters work	Energy consumption, W/m
Available range		20... 45	115... 150	10... 40								
Calculate process conditions		20	135	40	Calculate!	148.3	1.00	159.4	1.00	0.82	0.11	24.1
Optimise process	min	20	115	30	min Energy!		0.95		0.95	0.70		
	max	45	150	30	max Speed!	150		150				
	Optimal	39.9	142.0	30.0		150.0	0.97	148.2	0.95	0.77	0.17	19.3

Utilising this technological map for the first pultrusion process, increase of the pull speed by 50 - 125% and reduction of the energy consumption by 20 – 33% per 1 meter of pultruded profile have been achieved in dependence on the ambient room temperature.

	Technological map in industrial shop				**Optimised technological process**			
Pull speed, cm/min	20				29.9	35.4	39.9	45.0
Control temperature of electrical hearers, °C	135				138	141	142	142
Room and resin temperature, °C	**10**	**20**	**30**	**40**	**10**	**20**	**30**	**40**
Maximal temperature on profile surface, °C	146	146	147	148	147	150	150	150
Minimal degree of cure on profile surface	1.00	1.00	1.00	1.00	0.97	0.97	0.97	0.96
Maximal temperature on profile centreline, °C	161	161	161	159	150	150	148	146
Minimal degree of cure on profile centreline	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95
Minimal degree of cure on profile surface at die exit	0.82	0.82	0.82	0.82	0.77	0.79	0.77	0.73
Energy consumption, W/m	**33.4**	**30.3**	**27.2**	**24.1**	**26.7**	**22.6**	**19.3**	**16.2**

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