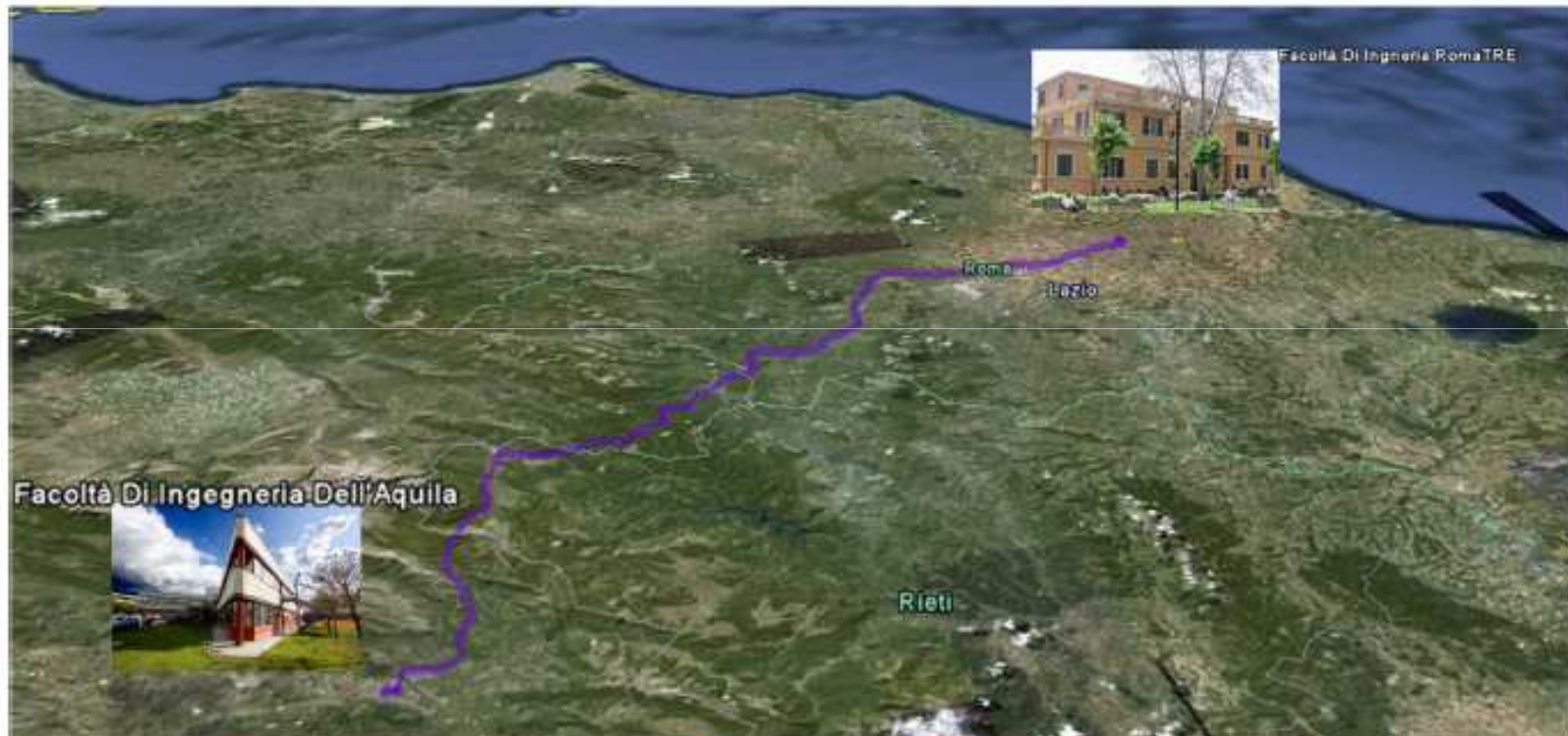




Università degli Studi dell'Aquila
&
Università di Roma TRE



XVI Summer School "Francesco Turco" Impianti Industriali Meccanici
Abano Terme (Padova, Italy) - 14-16 September 2011

Research team

Pacifico M. Pelagagge
Full Professor

pacifico.pelagagge@univaq.it

+39 0862 43.43.16



Mario Palumbo
Associate Professor

mario.palumbo@univaq.it

+39 0862 43.47.22



Gino Cardarelli
Associate Professor

gino.cardarelli@univaq.it

+39 0862 43.43.15



Paolo Salini
Contract Researcher

paolo.salini@univaq.it

+39 0862 43.43.21



Antonio C. Caputo
Full Professor

acaputo@uniroma3.it

+39 06 57.333.546



XVI Summer School "Francesco Turco" Impianti Industriali Meccanici
Abano Terme (Padova, Italy) - 14-16 September 2011

Teaching activity



L'Aquila

1. Impianti Industriali (9 CFU, LTG e LTM)
2. Gestione degli Impianti Industriali (9 CFU, LTG)
3. Sicurezza degli Impianti (6 CFU, LTG)
4. Gestione della Produzione Industriale (6 CFU, LMG)
5. Logistica Industriale (6 CFU, LMG)
6. Sistemi di Produzione Automatizzati (6 CFU, LMG)
7. Servizi Generali di Impianto (12 CFU, LMG)

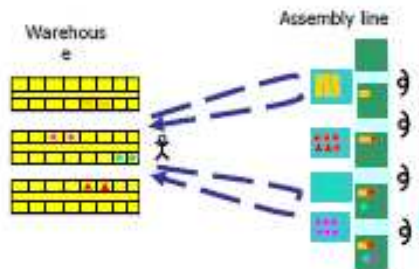
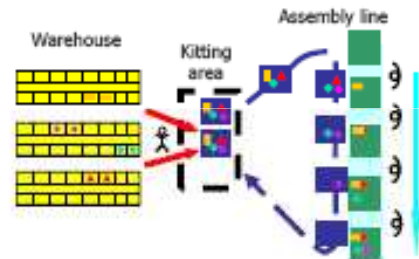
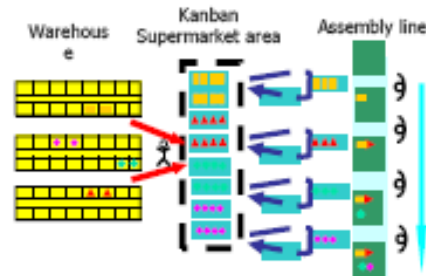
RomaTRE

1. Impianti Industriali (9 CFU, LMM)
2. Servizi Generali d'Impianto (6 CFU, LMM)
3. Gestione della Produzione Industriale (6 CFU, LMG)



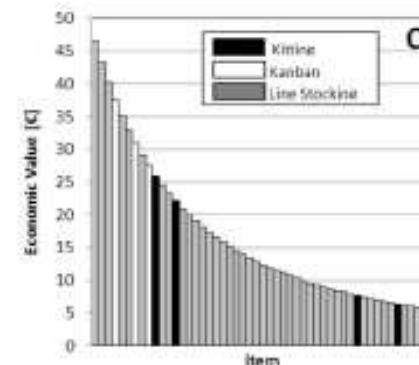
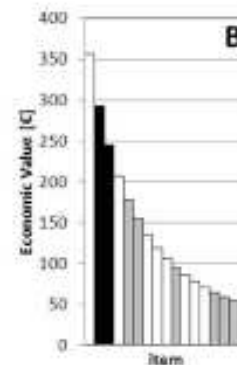
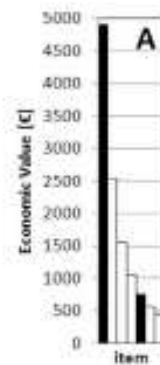
XVI Summer School "Francesco Turco" Impianti Industriali Meccanici
Abano Terme (Padova, Italy) - 14-16 September 2011

1. Methodology for selecting hybrid feeding policies for assembly systems.

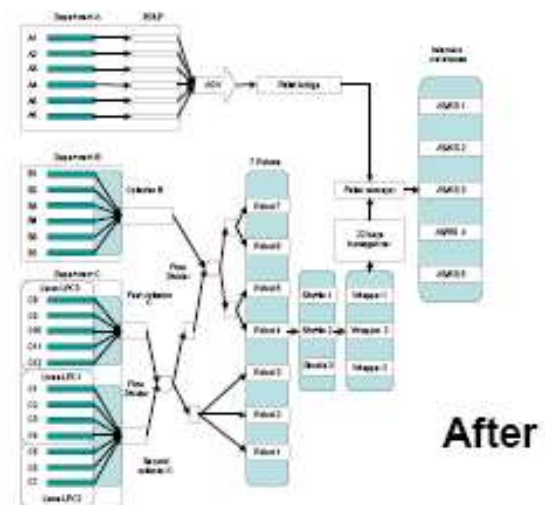
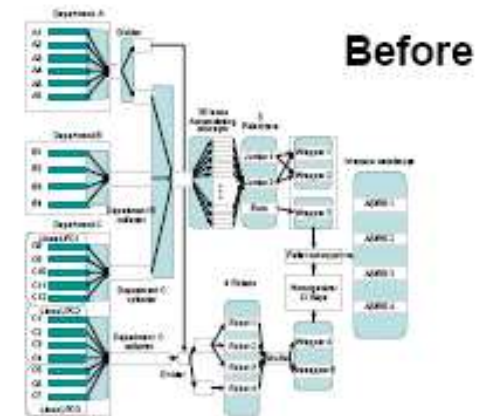
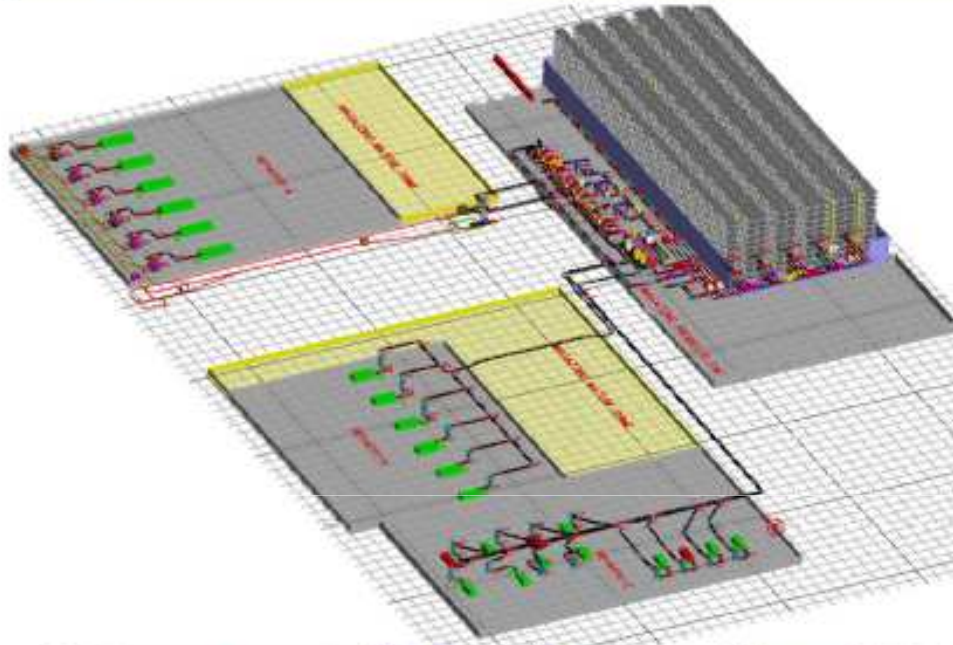


| A | B | C | Total cost (€/day) | A | B | C | Total cost (€/day) | A | B | C | Total cost (€/day) | A | B | C | Total cost (€/day) |
|----|----|----|--------------------|----|----|----|--------------------|----|----|----|--------------------|-------------------|----|----|--------------------|
| KI | KI | KI | 2369.9 | KI | LS | KA | 2655.6 | KA | KA | LS | 1775.2 | LS | KA | KI | 5038.9 |
| KI | KI | KA | 2717.0 | KI | LS | LS | 1709.2 | KA | LS | KI | 2553.0 | LS | KA | KA | 5085.5 |
| KI | KI | LS | 1799.6 | KA | KI | KI | 2614.4 | KA | LS | KA | 2719.6 | LS | KA | LS | 4259.0 |
| KI | KA | KI | 2492.1 | KA | KI | KA | 2781.0 | KA | LS | LS | 1772.2 | LS | LS | KI | 5035.8 |
| KI | KA | KA | 2658.7 | KA | KI | LS | 1833.6 | LS | KI | KI | 5097.2 | LS | LS | KA | 5082.4 |
| KI | KA | LS | 1711.2 | KA | KA | KI | 2556.1 | LS | KI | KA | 5163.8 | LS | LS | LS | 3942.8 |
| KI | LS | KI | 2499.0 | KA | KA | KA | 2555.5 | LS | KI | LS | 4216.4 | Genetic algorithm | | | 1316.9 |

ABC class-based or Genetic Algorithm optimized hybrid kanban, kitting and line storage policies



2. Capacity upgrade of large material handling and storage systems.



3.Reengineering of manufacturing systems in green manufacturing ECDM perspective



Hydraulic press plate bending



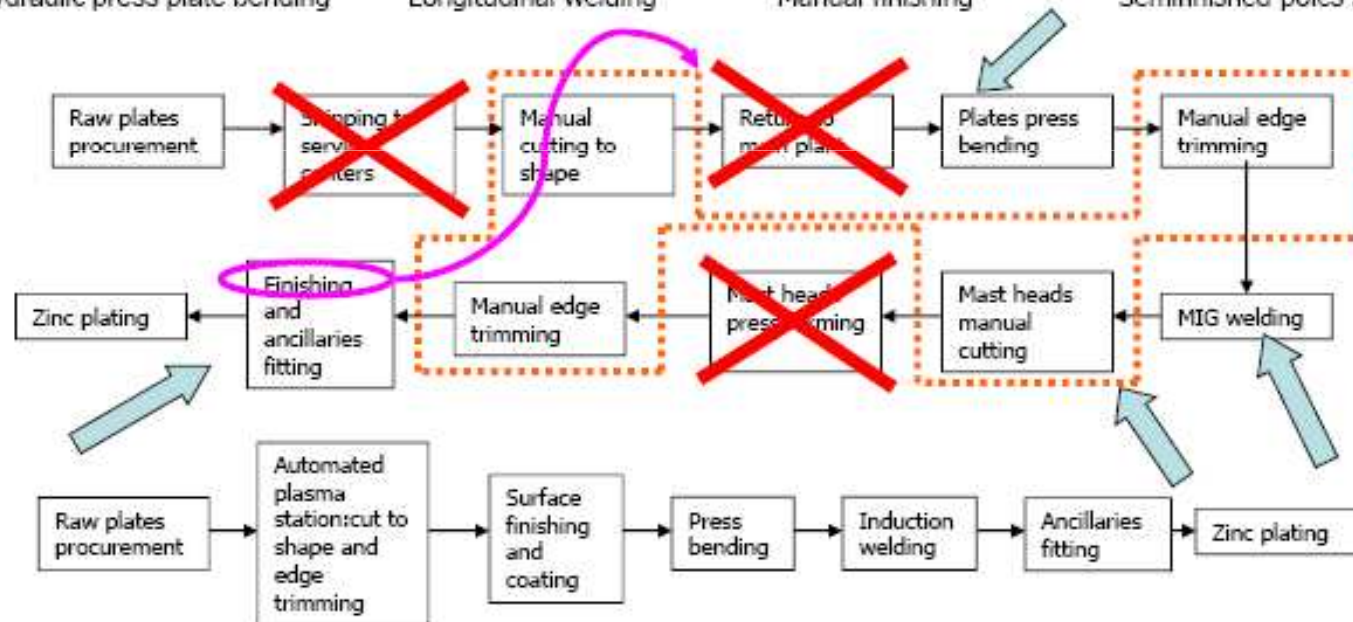
Longitudinal welding



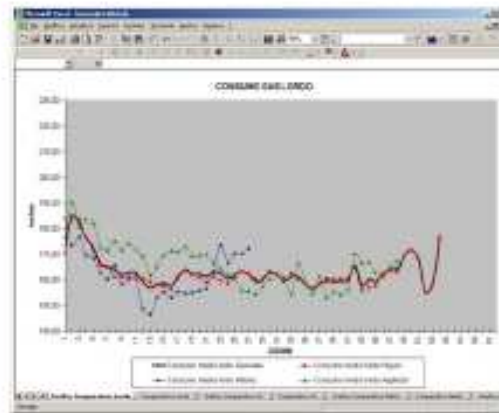
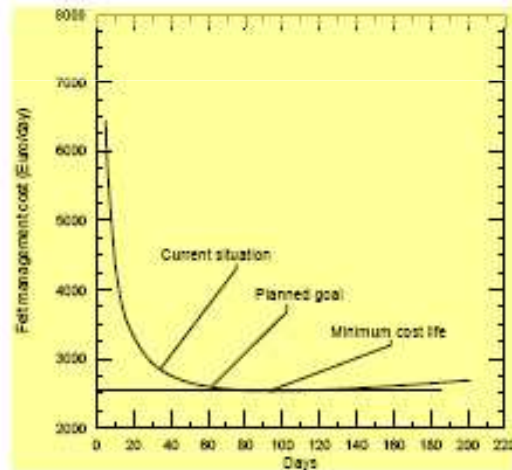
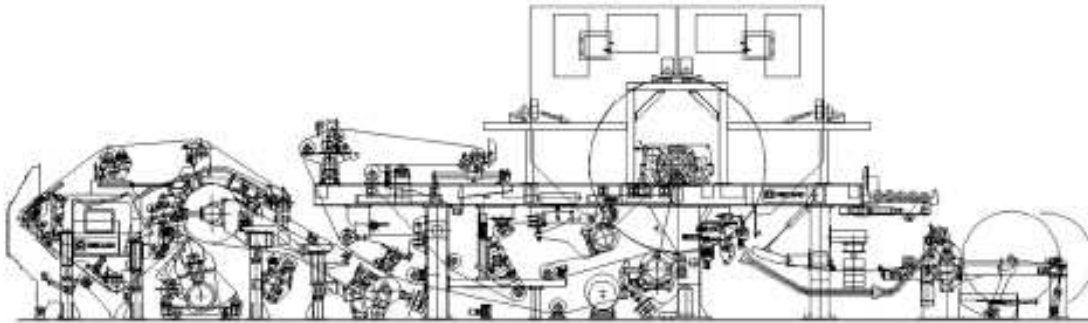
Manual finishing



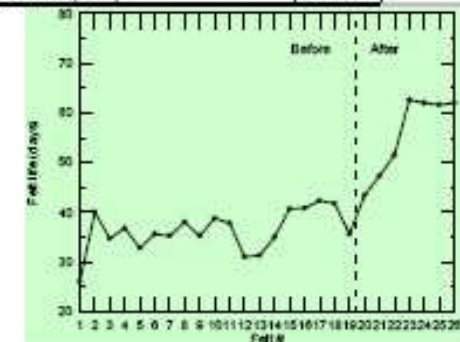
Semifinished poles storage



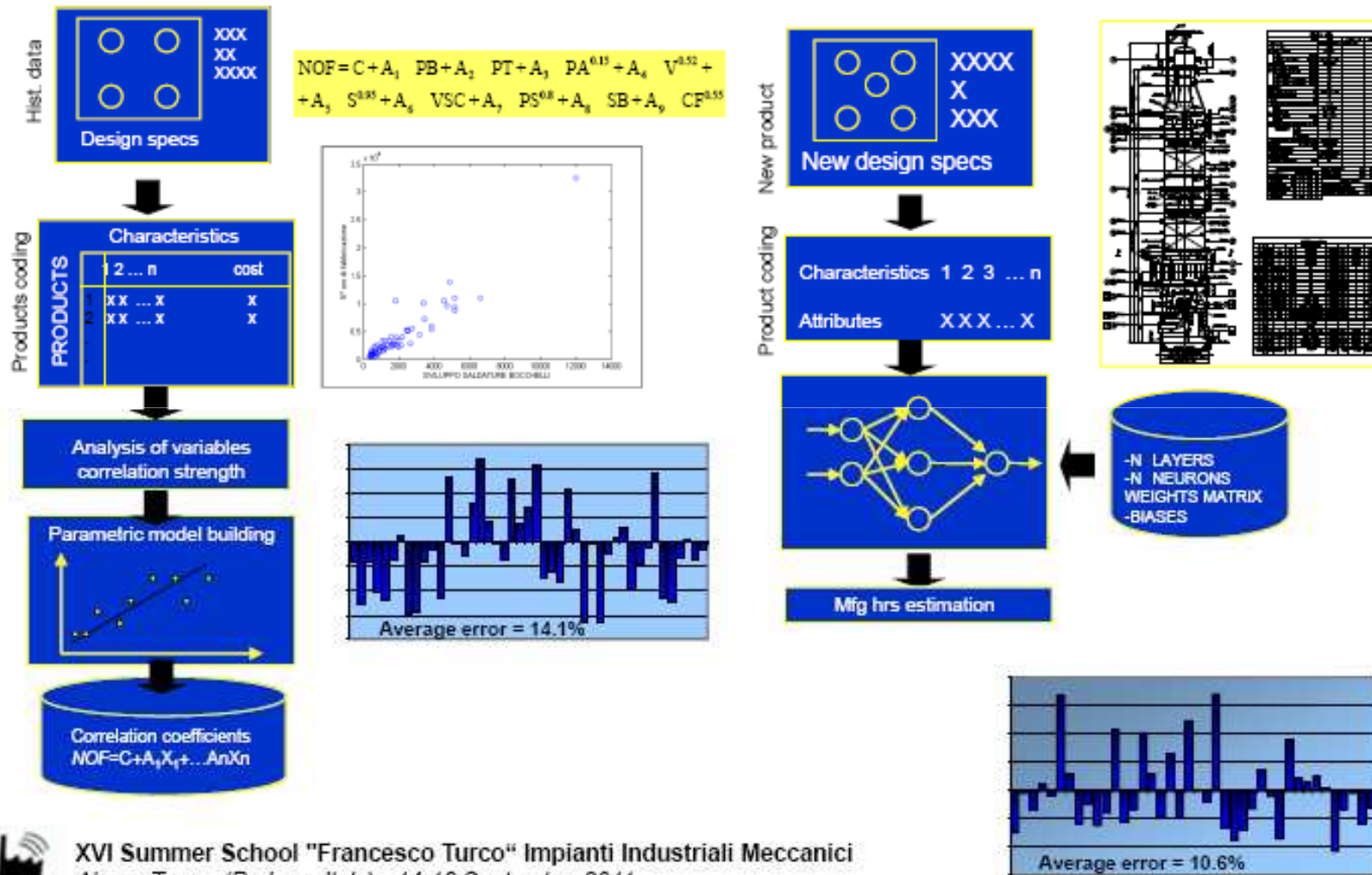
4. Optimization of felt life in tissue paper continuous machines



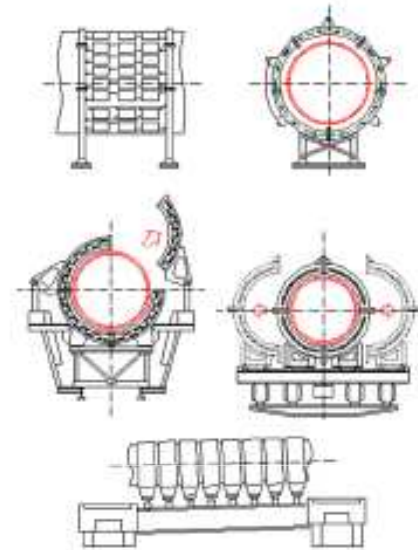
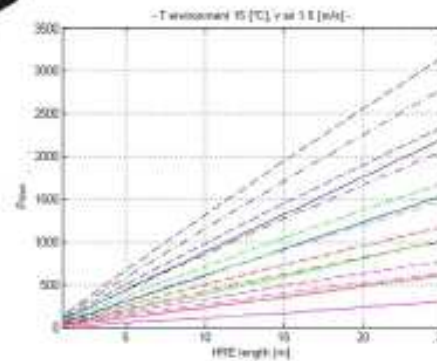
| | BEFORE | AFTER |
|--|-----------|---------|
| Average felt life (days) | 34 | 62 |
| Daily felt cost (Euro/d) | 2867 | 2592 |
| N. of felt replacements (year ¹) | 11 | 6 |
| Total felt changeover downtime (h/year) | 55 | 30 |
| Total annual cost (Euro/year) | 1.031.800 | 933.700 |
| OBTAINED RESULTS | | |
| Daily felt cost saving (Euro/d) | | 275 |
| Annual savings (Euro/year) | | 98.100 |
| Investment (Euro) | | 74.300 |



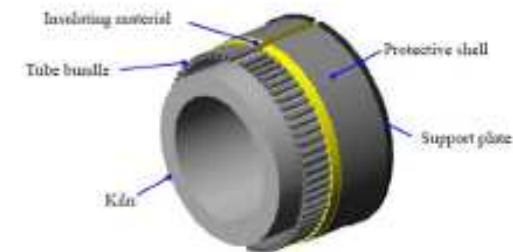
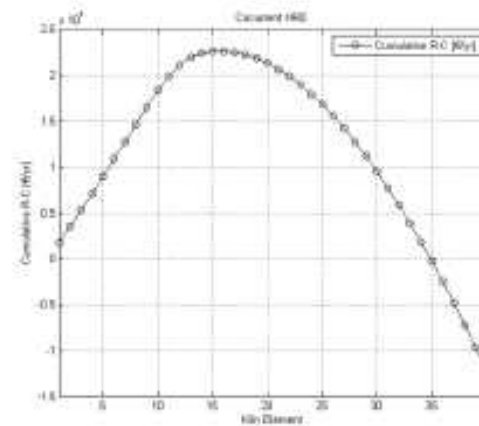
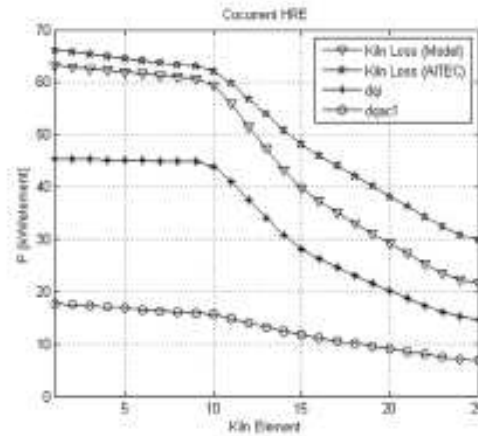
5. Parametric and neural cost estimation of process vessels



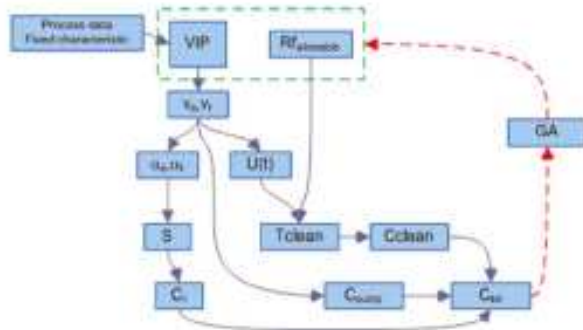
6. Modeling and analysis of radiant heat recovery exchangers from rotary kilns



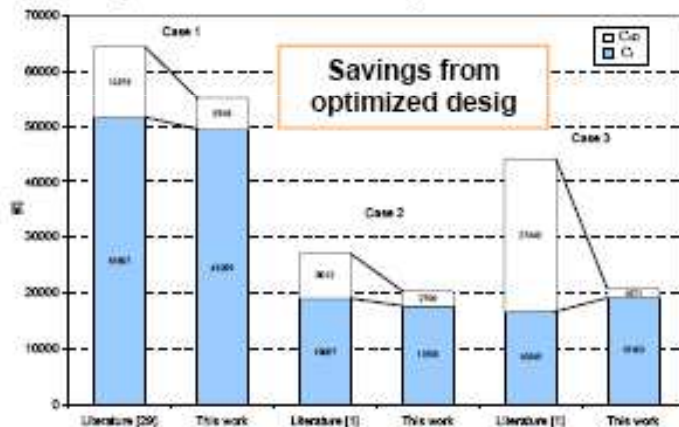
$$\begin{cases} \frac{dT_a(x)}{dx} = -(K_1 + K_2) \cdot T_a(x) + K_2 \cdot T_{H_2O}(x) + K_1 \cdot T_{k,avg} \\ \frac{dT_{H_2O}(x)}{dx} = -K_3 \cdot T_a(x) + K_3 \cdot T_{H_2O}(x) + K_4 \cdot T_{H_2O}^4(x) - K_4 \cdot T_{k,avg}^4 \end{cases}$$



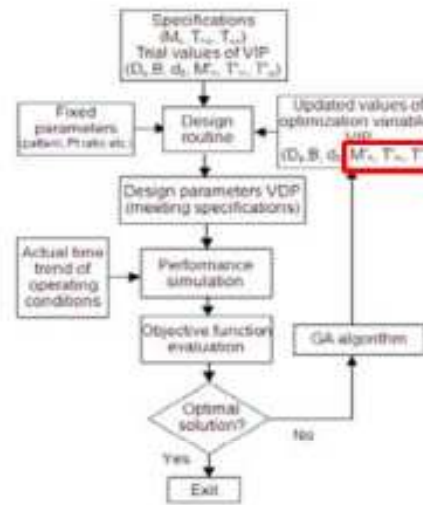
7. Economic optimization of heat exchangers design and maintenance



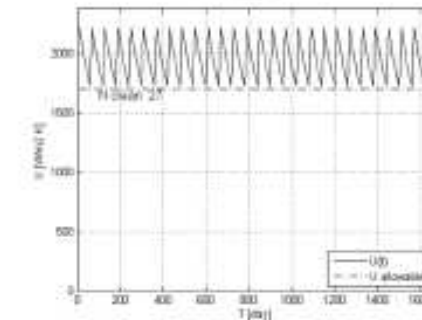
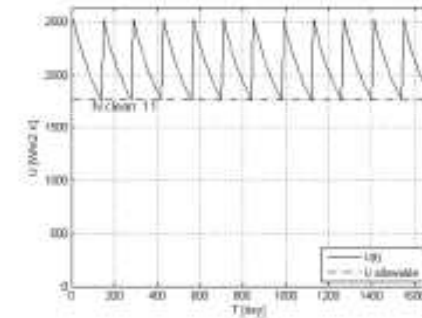
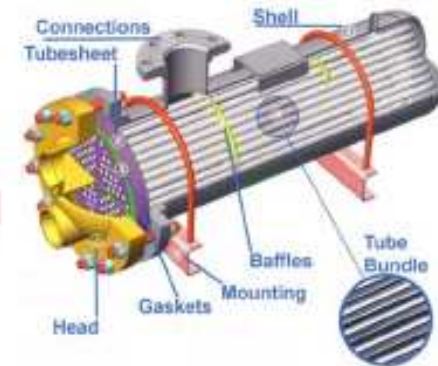
Joint optimization of HE design and maintenance



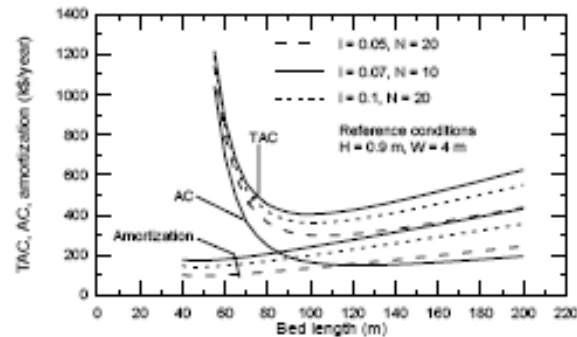
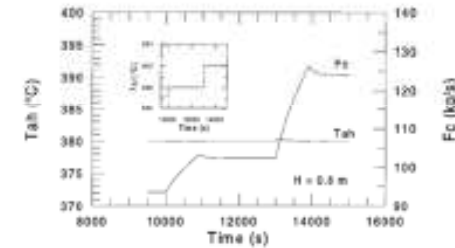
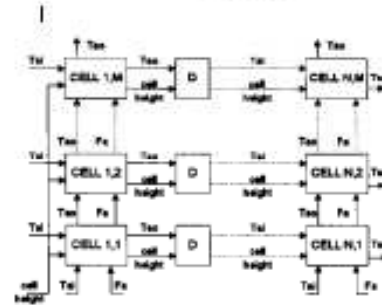
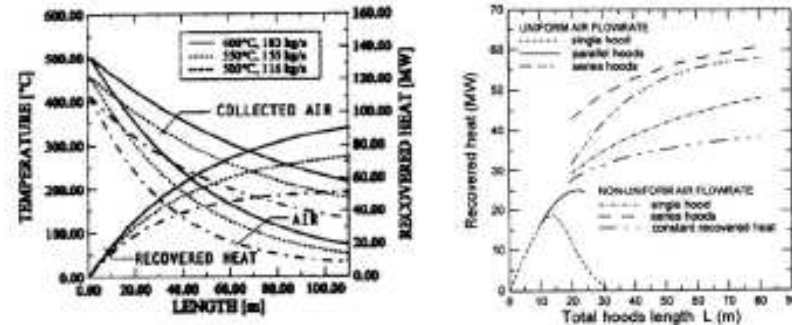
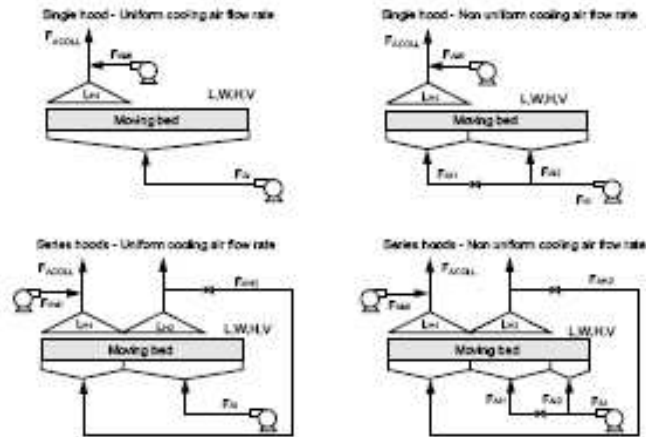
$$C_{tot} = C_1 + \sum_{i=1}^{N_{yr}} \frac{C_{op}(1+f)^i}{(1+s)^i} + \sum_{i=1}^{N_{yr}} \frac{N_{clean} [(C_{clean,i} + C_{ATX,i} + C_{M,i}) + \int_0^{T_{max}} C_{E,i}(t) dt]}{(1+s)^i} + \sum_{j=1}^v \alpha_j P_j C_{fix}$$



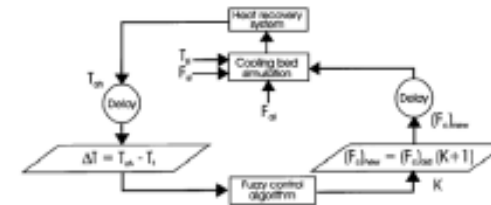
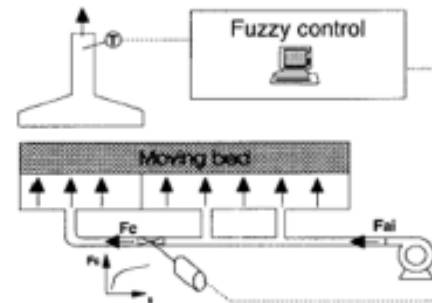
Algorithm for Design optimization under stochastic operating conditions



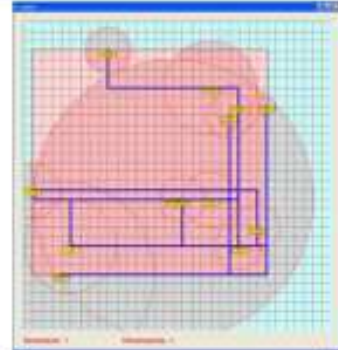
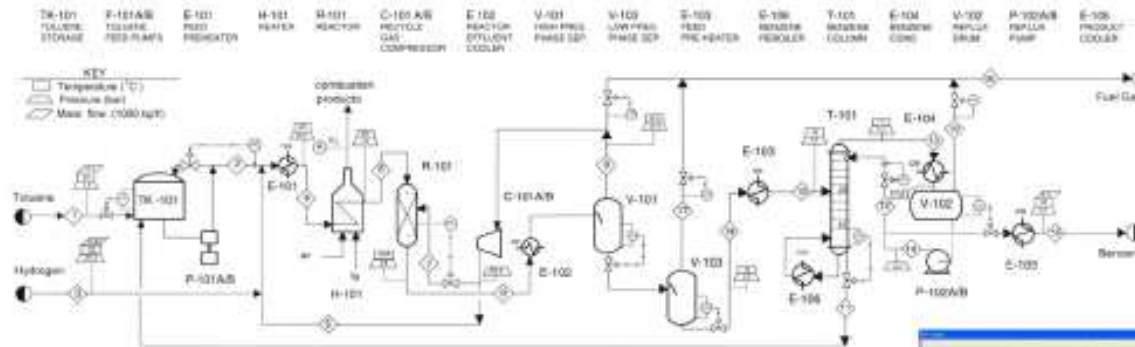
8. Optimization of heat recovery systems from solid beds cooling



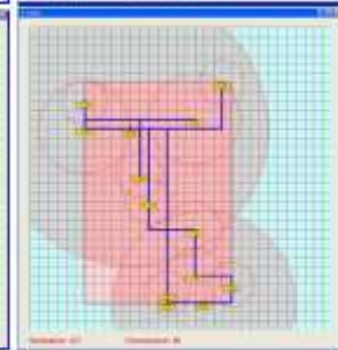
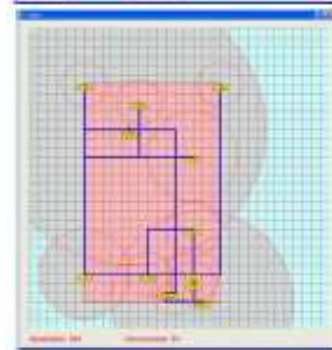
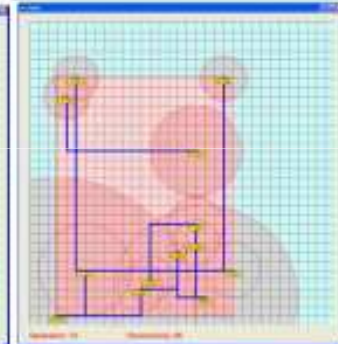
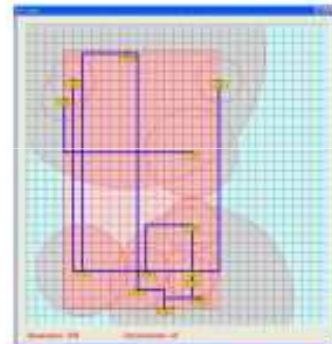
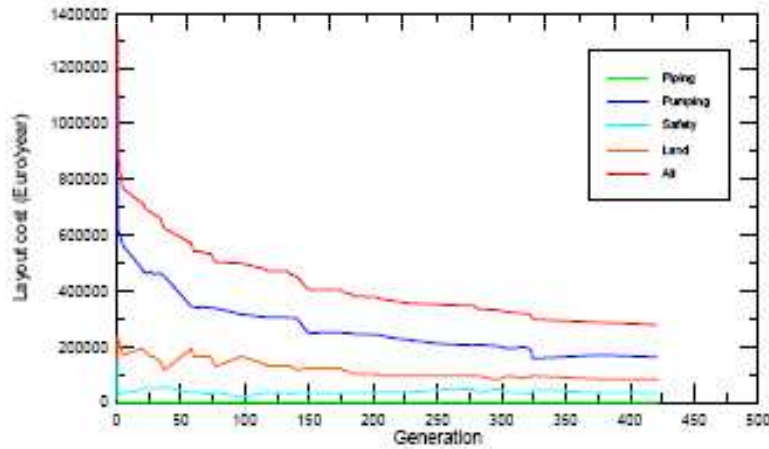
Determinazione lunghezza ottimale letto di raffreddamento



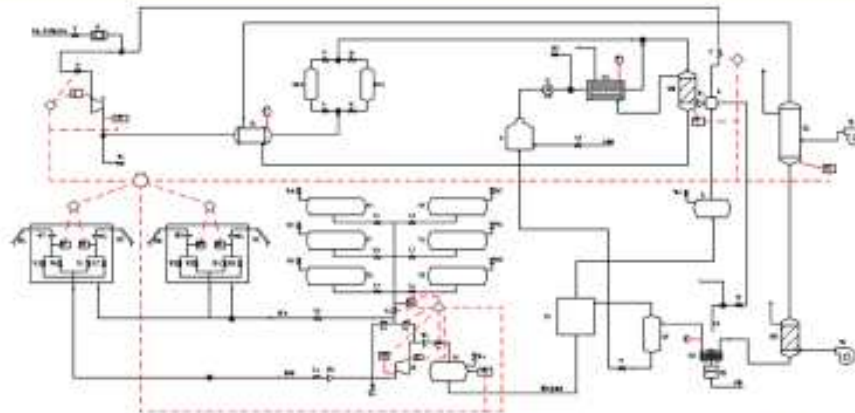
9. Safety-based process plant layout using GA



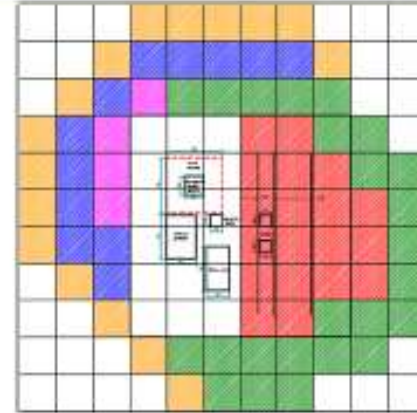
Piping + Pumping + Safety + Land



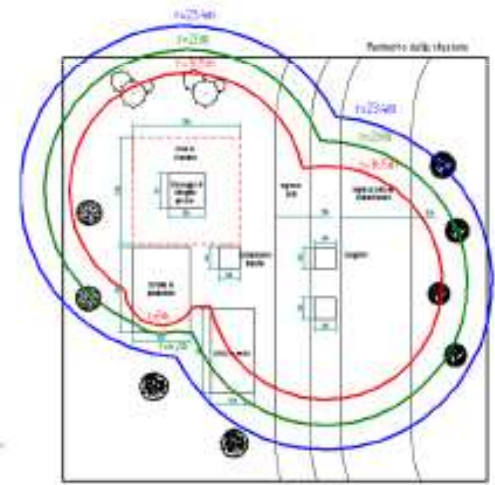
10. Risk assessment of hydrogen refuelling stations



Red: IR= 10^{-4}
 Purple: IR= 10^{-6}
 Green: IR= 10^{-5}
 Blue: IR= 10^{-7}
 Orange: IR= 10^{-8}



| Event | IR | Frequency | Consequence |
|------------------|--------|-----------|------------------|
| Unstable release | IR 0.8 | 1.5E-8 | Unstable release |
| Jet fire | IR 0.2 | 1.5E-8 | Jet fire |
| Dispersion | IR 0.3 | 1.5E-8 | Dispersion |
| Flash fire | IR 0.7 | 1.5E-8 | Flash fire |
| VCE deflag | IR 0.1 | 1.5E-8 | VCE deflag |
| VCE deton | IR 0.1 | 1.5E-8 | VCE deton |
| Jet fire | IR 0.7 | 1.5E-8 | Jet fire |
| Dispersion | IR 0.3 | 1.5E-8 | Dispersion |
| Flash fire | IR 0.8 | 1.5E-8 | Flash fire |
| VCE deflag | IR 0.1 | 1.5E-8 | VCE deflag |
| VCE deton | IR 0.1 | 1.5E-8 | VCE deton |



Avg individual death risk $2.4 \times 10^{-4} \text{ year}^{-1}$



Top 10 Publications

| Authors | Title | Journal | Year, Vol, pp | Research topic |
|--|--|--|--|----------------|
| Caputo A.C., Pelagagge, P.M. | Heat Recovery from Moving Cooling Beds: Transient Modeling by Dynamic Simulation | <i>Applied Thermal Engineering</i> | 1999, 19, 21-35 | 1 |
| Caputo A.C., Pelagagge, P.M. | RDF Production Plants: Part I Design and Costs Part II Economics and Profitability | <i>Applied Thermal Engineering</i> | 2002, vol. 22, 423-437 and 439-448 | 1 |
| Caputo A.C., Pelagagge, P.M. | Effects of product design on assembly lines performances: A concurrent engineering approach | <i>Industrial Management & Data Systems</i> | 2008, 108, 726-749 | 1 |
| Caputo A.C., Pelagagge, P.M., Salini P. | Joint Economic Optimization of Heat Exchanger Design and Maintenance Policy | <i>Applied Thermal Engineering</i> | 2011, 31, 1391-1392 | 2 |
| Caputo A.C., Pelagagge, P.M., Salini P. | Performance Modeling of Radiant Heat Recovery Exchangers for Rotary Kilns | <i>Applied Thermal Engineering</i> | 2011, doi 10.1016/j.applthermaleng.2011.04.024 | 2 |
| Caputo A.C., Pelagagge, P.M. | Parametric and Neural Methods for Cost Estimation of Process Vessels | <i>International Journal of Production Economics</i> | 2008, 112, 934-954 | 3 |
| Caputo A.C., Pelagagge, P.M. | Management criteria of automated order picking systems in high rotation high volume distribution centers | <i>Industrial Management & Data Systems</i> | 2006, 106, 1359-1383 | 5 |
| Caputo A.C., Pelagagge, P.M. | A Methodology for Selecting Assembly Systems Feeding Policy | <i>Industrial Management and Data Systems</i> | 2011, 111, 84-112 | 5 |
| Caputo A.C., Fratocchi L., Pelagagge, P.M., | A Genetic Approach for Freight Transportation Planning | <i>Industrial Management & Data Systems</i> | 2006, 106, 719-738 | 6 |
| Caputo A.C., Palumbo M., Pelagagge P.M., Scacchia F. | Economics of biomass energy utilization in combustion and gasification plants: effects of logistic variables | <i>Biomass & Bioenergy</i> | 2005, 28, 35-51 | 6 |

Research Topics – Ing/Ind-17

| | | | | | | |
|---------------------------------------|-------------------------------------|---------------------------------------|---|------------------------------|-----------|------------------------------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Production system analysis and design | Auxiliary plant analysis and design | Processes and production technologies | Ergonomics and safety of industrial systems | Production system management | Logistics | Production system automation |

Recent research projects, partners and collaborations

EEUU (Life). Design and start up of a plant producing compost from olives processing waste.

FATER (Procter & Gamble Group). Development of innovative solutions for automated handling of raw materials and finished goods.

SANOFI-AVENTIS. Energy audit and economic analysis of energy saving measures for plant utilities.

Assut Europe. Feasibility analysis of a line producing composite polymeric textile fibres for surgical use.

Other collaborations: Bianchi Vending Group, Merker Yshima, Emsar, Adivar Comifar, Vibac etc.

