Development of Knowledge & Press-Test based Heatset Simulator

Knowledge Management meets the NIP

IC Conference Nörrkoping 2011

 Peter Herman,
 Sinapse Print Simulators - www.sinapseprint.com

 Contributions: Laurent Grimaldi Sinapse; Gerd Carl UPM







Simulators - Changing over Time

SIR Heatset Web Offset

Publication gravure

Newspaper (single web)

Sheetfed Offset (SHOTS)



Flexographic & Gravure Packaging

Newspaper (Multiweb)

Educational Server (LMS) WebSim-Heatset Expert EncuPack UV Offset,

3

eurostars™





Sinapse Print Simulators - 2011

•Specialised in printing /packaging simulators

•c. 2000 installed

Products

	SheetSim	WebSim	WebSim	PackSim	Pac	kSim
	SHOTS	Heatset	News	Flexo	Grav	vure
Applications	Sheetfed	Heatset	Coldset	Flexo	Gra	vure
Commercial printing	•	•				
Publishing	•	•	•		●	
Newspapers		•	•			
Packaging	•			•		
Training organ.	•	•	•	•	•	
Suppliers	•	•	•	•	•	
						Sinap

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Print Sin

Why Simulators ? - Same reasons as other industries

- 1. Learn by doing and by making mistakes Much Less expensive on a simulator, **costs** are virtual not real Carbon cost of real press run ?
- 2. Active learning, not passive Highest retention rate of learning methods
- 3. Accelerated learning Condense experience
- 4. Structured, progressive, repeatable, documented Common approach to <u>problem-solving</u>
- 5. Objective criteria & method for evaluation Get baselines, set training goals, evaluate progress



SHEETFED - 6-color





2nd (Additional) Heidelberg Interface - WorldSkills 2011



WorldSkills London

2 SM 52 presses 5 SHOTS simulators

45 countries present 14 compete in offset

Official Supplier





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HEATSET -M600 Omnicon Interface Version



4-Color Single Web 16-page ¼ Fold



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Flexo Simulators : 3 Press Types





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Gravure Packaging: Reel/Reel or Cut/Crease



7-Color

Reel->Reel (flexible)

Reel-> Cut/Crease (boxes)





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Development of new Heatset simulator subject of presentation



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Print Simulators

Architecture – Knowledge Base

Component (mechanical, material, environmental) Subcomponent + Attribute + Value Value range (equilibrium) diséquilibria-> Process problems

This is model-driven (top down), can be used for diagnostics (bottom-up)

Process problems (behaviour) Downstream effects Temporal Evolution Effects on other components/attributes/values (-> other problems)

Effects on system output (printed substrate) Visual models

Initial systems combined static data, internal curves, heuristics





Some of the 70+ test scenarios from the FEG Group

Some « Technical Audit Scenarios » : As used by SUN Chemical

- •Ink Tank temperature too low
- •Current reel (paper) temperature cold
- •Reel & New reel temperature too cold
- •Pipe blocked
- -Dampening solution T° too high
- •Dampening solution T° too low
- •Print unit Ink Roller T° too high (Bad settings)
- •Print unit Ink Roller T° too high (not enough lubrication)
- •Print unit Ink Roller T° too high (set too high cooling system)
- •Print unit Ink Roller T° too high (failure cooling system)
- •Print unit Ink Roller T° too high (cooling pipes blocked)
- •Print unit Ink Roller T° too high (cooling system set too low)
- •Fount roller T° too high (Fount Roller lubrication poor)
- •Plate T° too high (Plate cylinder packing too thick)
- •Blanket T° too high (Blanket packing too thick)
- •Chill roller Temperature set too low
- •Chill roller Temperature set too high
- Chill roller cooling system blocked



Sample of implementation in the Simulator



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Part of Knowledge Base, Scenario Generator, Help System

Malfunctions	
By fault By family faults By component	
Infeed squeeze roll	Plate cylinder packing too thick.
🖃 🗖 Printing unit	CAUSE Location:
Registration wheels	Color Side
guards	
🚊 🖬 📘 Inking system	
Ink feed roller	
Cooling System	
Inking system rollers	
Form rollers	
Riding rollers	CAUSE INTENSITY (minimum):
🚊 📕 Ink fountain	
Ink metering screws	Low — High
Plate cylinder	
Plate cylinder packing	
Plate	
Blanket cylinder	
Blanket	
Next Blanket	List of Faults:
	Selected Not selected Compute
Cause type: 🔽 Menu 🔽 🔽 Console	Registration
Gum-arabic quality poor.	Dry - Scumming (Plate temperature too high)
Plate quality poor.	Dot gain
■ Plate transfer worn.	
Plate temperature too high	
Initial Cause: Plate cylinder packing too thick.	Ξ
Screen ruling too large for the paper	
Screen ruling too small for the paper	▼
Save	Cancel

Showing « Top-down » view





Example: variable, scenario, visualisation

Causes : dryer temperature too high

S1 Direct : Through the Dryer area3 temperature adjustment S2 Induced : Through a wrong drying profile (drying too fast)



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Print Simulators

Step 2 : PPD project : UPM, VTT, Sinapse Paper-based modelling in Heatset 3 calendar years

UPM Reasons for Extending Simulator



Reproduced from 2009 presentation by Gerd Carl of UPM: Sinapse Simulators in UPM Printing Process Workshops

Share knowledge inside UPM

Our own team of Technical Sales Managers need to broaden their field of knowledge with more printing processes and need to maintain their skill levels

-Our customers' world is changing

Less skilled people are available to share their knowledge with younger people after the big wave of Experts went to retirement between 2008 and 2015



Deeper Model of interaction : 15 faults, 9 paper types

		Fault n°	1	2	3	4	5		6	7	8	9	10	11	12	13	14	15
noneD		Name	Blistering	Print through	Positive piling	Negative piling		Mechanical Ghosting	Cracking of coating	Fiber cracking	Fiber puff	Dot gain / Density / Scumming	Linting	Fluting	Static electricity	Scuffing	Dusting	Smearing
1	NP	UPM News 45 g	0	<u>1</u>	1	0	0		0	<u>1</u>	0	<u>1</u>	<u>1</u>	0	?	0	<u>1</u>	0
2	SC-A	UPM Max 52 g (SC example)	0	<u>1</u>	<u>1</u>	0	0		0	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	0	<u>1</u>	0	<u>1</u>	0
3	SC-A+	UPM Smart 52 g	0	<u>1</u>	<u>1</u>	0	0		0	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	0	<u>1</u>	0	<u>1</u>	0
			4	0		4	4		0	4		4	0	4	4	0	0	4
4	LVVC gloss	UPINI Cote 60 g (LWC example)	1	0	1	1	1		?	<u>1</u>	<u>1</u>	<u>1</u>	0	<u>1</u>	<u>1</u>	0	0	1
5	MFC	UPM Matt 54 g	0	?	<u>1</u>	<u>1</u>	?		?	<u>1</u>	<u>1</u>	<u>1</u>	0	0	?	?	<u>1</u>	<u>1</u>
6	MWC matt	UPM Star M 80g	<u>1</u>	0	<u>1</u>	<u>1</u>	<u>1</u>		<u>1</u>	<u>1</u>	0	<u>1</u>	0	<u>1</u>	0	<u>1</u>	<u>1</u>	1
7	WFC gloss	UPM Finesse Gloss 90 g	<u>1</u>	0	<u>1</u>	<u>1</u>	<u>1</u>		<u>1</u>	<u>1</u>	0	<u>1</u>	0	<u>1</u>	0	0	0	<u>1</u>
8	WFC light matt	UPM Finesse Classic Matt 70 g	<u>1</u>	0	<u>1</u>	1	<u>1</u>		<u>1</u>	<u>1</u>	0	<u>1</u>	0	<u>1</u>	<u>1</u>	?	<u>1</u>	<u>1</u>
9	WFC heavy mat	t UPM Finesse Matt 130 g	1	0	1	1	1		1	0	0	1	0	1	0	1	1	1

 Density and dot gain curves were based on versatile printing trials in HSWO press. Ink feed and fountain solution feed curves were made for nine papers with two different ink and different screen ruling. *Trial data was modified for simulator to better respond for learning and training purposes (see curve editor below)* Fault behaviour was based on available data, practical experience on printing and discussions between different experts of printing and paper making
 Leo Hertzen : VTT



Data matrixes from VTT <u>Press tests</u>: per paper, per set of variables

	Print	Ink duct speed	Ink screw opening	Fount step (%)	FS duct speed	Control bars	Filter	Solid density	25%	20%	75%	Dot gain 25 %	Dot gain 50 %	Dot gain 75 %	Density at 25%	Density at 50%	Density at 75%	Dot gain 25 %	Dot gain 50 %	Dot gain 75 %
67-45.Black		37	41	2	120 lpi- 5345l/cm	1B		1,48	67,2	91,8	98,1	0,48	0,12	0,03	0,992	1,355	1,448	67,9	48,9	24,8
67-45.Black		37	42	2	120 lpi- 5345l/cm	2B		1,41	64,1	91,1	98 <i>,</i> 6	0,51	0,13	0,02	0,946	1,345	1,455	67,3	49,3	25,4
67-45.Black		37	28	2	120 lpi- 5345l/cm	3B		1,34	58,2	87	98,5	0,56	0,17	0,02	0,859	1,284	1,454	65,3	49,3	26,1
67-45.Black		37	28	2	120 lpi- 5345l/cm	4B		1,39	55,6	85,9	96,9	0,62	0,20	0,04	0,821	1,268	1,430	63,5	48,6	25,3
67-45.Black		37	27	2	120 lpi- 5345l/cm	6B		1,19	44,8	75,7	93	0,66	0,29	0,08	0,661	1,117	1,373	58,6	48,8	27,4
67-45.Cyan		47	49	2	120 lpi- 4845l/cm	1C		1,47	51	81,9	96,3	0,72	0,27	0,05	0,753	1,209	1,421	60,2	47,1	24,6
67-45.Cyan		47	55	2	120 lpi- 4845l/cm	2C		1,49	47,5	79,6	95,6	0,78	0,30	0,07	0,701	1,175	1,411	57,8	46,4	24,3
67-45.Cyan		47	47	2	120 lpi- 4845l/cm	3C		1,37	44,5	74,1	93 <i>,</i> 4	0,76	0,35	0,09	0,657	1,094	1,379	56 <i>,</i> 5	46,1	25,1
67-45.Cyan		47	48	2	120 lpi- 4845l/cm	4C		1,32	41,7	73,6	94,1	0,77	0,35	0,08	0,615	1,086	1,389	54,6	46,4	25,7
67-45.Cyan		47	44	2	120 lpi- 4845l/cm	6C		1,05	39,4	70,7	89,6	0,64	0,31	0,11	0,582	1,044	1,322	56,0	49,9	29,6



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VTT data -> entry in table of papers, problems, curves



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Curve Editor : Allows UPM to modify/generalize behavior



If Print Experts think original curve too narrowly defined for training, They can adjust it.

Curve orignally = set of data from 1 press run. Each press run is individual.



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Press Console - inking- Operator modifies density





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Curve for blistering: min/max thresholds

OVERVIEW		350	Level
Faults		335-	l evel
Blistering		320	-
Save		305	-
Parameters	Ê	290	•
Scenario	erTel	275-	•
Dryer temperature	D ₁	260-	-
ListLot		245-	_
		230	_
		215	-
Blistering is result of too high drying		200	_
temperature or too (fast drying profile). Water in base paper evaporates through coating layer		0 1 3 4 5 7 8 9 11	12
and ink layer. Bilstering occurs if evaporation rate is too high and costing/ink layer too dense. This leads to too high pressure of vapor inside the paper and delamination of the paper.		InkCoverage	
	Edit	t	
Parameters		State State 2 Create Copy	Show
Curve	x	<pre></pre>	
Paper		CopyClipboard Level 0.00 ▼ CopyTo -> Level 0.00 ▼ Up	UpAl
Ink		c- <-> -> CopyClipboard Down	Down
Ink for paper LWC			
Color	Off	fset	CopyClip
Cyan		oryer profil type Value NP	Clea
Parameters		Show OffsetY 0.00	



PPD Faults too sophisticated for some : can be turned on/off

PPD Faults Enable Lack Print Through Smearing Image: Starting Scuffing Image: Scuffing becoming Image: Scuffing Cracking of Coating Image: Scuffing Image: Scuffing Image: Scuffing <th>PPD Faults Management</th> <th></th> <th>×</th>	PPD Faults Management		×
Image: Print Through Image: Smearing Image: Print Through Image: Smearing <td>PPD Faults Enable</td> <td></td> <td>Lack of Heatset</td>	PPD Faults Enable		Lack of Heatset
Image: Content of Solicon marks Image: Content of Solicon marks Image: Fiber puff Image: Solicon marks Image: Content of Solicon marks Image: Fiber puff Image: Solicon marks Image: Content of Solicon marks Image: Fiber puff Image: Solicon marks Image: Solicon marks Image: Fiber puff Image: Solicon marks Image: Solicon marks Image: Fiber puff Image: Solicon marks Image: Solicon marks Image: Fiber puff Image: Solicon marks Image: Solicon marks Image: Fiber puff Image: Solicon marks Image: Solicon marks Image: Fiber puff Image: Solicon marks Image: Solicon marks Image: Fiber puff Image: Solicon marks Image: Solicon marks Image: Fiber puff Image: Solicon marks Image: Solicon marks Image: Fiber puff Image: Solicon marks Image: Solicon marks Image: Fiber puff Image: Solicon marks Image: Solicon marks Image: Solicon marks Image: Fiber puff Image: Solicon marks Image: Solicon marks Image: Solicon marks Image: Solicon marks Image: Fiber puff Image: Solicon marks Image: Solicon marks Image: Solicon marks Image: Solicon mark	 Print Through Blistering Positive Piling Negative Piling Ghosting Fiber puff Linting Dusting Fluting 	 Smearing Scuffing Cracking of Coating Fiber Cracking Silicon marks Spotting Fan Out Static Electricity Shrinking 	knowledge is becoming a problem in training centers and in companies
OK Annuler Simulators - Simulators and software for the graphic industries - www.sinapseprint.com	Sinanse Print Simulators - Simulators and	OK Annuler	Sinapse Print Simulators



SC/LWC : different inks, screens, dryer profiles, plates, behavior



Examples of Current Use of HEATSET EXPERT version UPM Training Centers in Europe/China



Simulator integrated into press console

Like Flight Simulator

'Cockpit' for printers



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UPM Training : 2009:beginner/intermediate level, 2011 added expert level



No	Date	Process	Language	Level
1	29.04.2009	SFO	English/german	beginner
2	12.05.2009	HSWO	English	beginner
3	26.05.2009	HSWO	German	intermediate
4	03.06.2009	optional	English	open
5	16.06.2009	HSWO	English	intermediate
6	07.07.2009	SFO	English	intermediate
7	09.07.2009	HSWO	English	intermediate
8	08.09.2009	optional	English/ german	open
9	23.09.2009	HSWO	German	intermediate
10	29.09.2009	CSWO	English	beginner
11	06.10.2009	HSWO	English	beginner
12	21.10.2009	SFO	German	beginner
13	27.10.2009	SFO	English or spanish	beginner
14	05.11.2009	optional	English/german	open
15	11.11.2009	CSWO	English	intermediate
16	24.11.2009	optional	English	intermediate

UPM has access to **all** paper types.

Commercial heatset version currently has SC/LWC available.

Other paper types will be introduced over time.



Sample UPM print job - low M density, magnifier and dots





Transcontinental- Training in Mexico: Remote Supervision



Exercises: Learner Level, Production Problems, Training Goals



RR Donnelley in USA: Remote Supervision

RRD requirements for training: Technology Driven, Self Guided, On-Site



RRD Trainers : Working on Problem Solving



Danville KY, Crawfordsville and Roanoke discussing simulator

40+ RRD plants participate in Simulator-based Training





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Cart

Sample RR Donnelley Print Job

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A project's outcome and total cost of ownership their prepare your content for printed, pigital begins with the preparation process. So we offer a large of collaborative services to hep you each your goals, from your project's incedion or other distribution. Our technologies and craftenanship help to streamline workflows, deliver exceptional quality, and set the stage for bet. he matter your communicators challenge, we offer to effective production We speak your language. Literally other resources ... plus services for capital a full range of integrated, best in-class optio markets and other tinancial compliance and transaction needs. In countries on four continents RR Donnelley stratoyees are helping customers with local projects, multi-country programs, and full eight For integraled international programs, we have production and distribution. So if you have locations in Lafn America, Europe, and Asia, as well as across North America, we can look all production and fulfilment strategies that leverage RR Donnelley's extensive international platform. connected our Cuetoministic system to backlike in the United Kingdom and France, opening the door to inlegabled pilot management programs in North America and Europe. • Our Asia platform includes print production in Our Asis platform includes print production in facilities in India and Chrina, capital markets and other semices throughout the region. Plus, we offer a variety of business services outnourcing capitalities through RR. Donnelley operations For example ... • RR Dorwelley is the largest provider of printing and related services in Latin America, with facilities in L3 countries. Our Latin America operations offer comprehensive premedia in Asia, including legal support services and service, print production, and logistics - for a superb end-to-end menurce. other outsourcing. Whether you are drawing on our facilities in If you are producing in the United States for Asia for production for export to Europe on North America, or supporting your own Asia operations, RR Donnelley offers a conduit to this shipment to locations in Latin America, let us show you the savings associated with local production. Or, if you have operations in Latin America, we can provide local service with a last-growing region. Though RR Donnelley is a global company, will offices in 14 different time zones, our approach everywhere is based on an intense commitment personal service. So you'll enjoy these worldwide In Europe, we after design, premedia, print production, document and content management and distribution services, print-and-mail, and resources and best practices with a distinctly

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SHOTS Heard Around the World: Contest 2011-2012

Team Competition (max 5 per team)

Nov 2011 : 1st Round : 'n' teams: Dec 2011 : 2nd Round : n/2 teams; Jan 2012 : 3rd Round : 'n/4' teams;

Individual scores* -> Team Average Individual scores -> Team Average Individual scores -> Team Average

> •Score= virtual production cost

Individual Competition – Best from top 8 Teams

Feb 2012 : Mar 2012 :

Quarter Final: Semi Final[.]

8 Individuals (from 8 top teams) 4 Individuals

FINALS – LIVE – (paid trip) at DRUPA

May 2012: 2 individuals



Partners







European Project Partnership: FP7 - proposal for 1.2012 WP 2011-2012 Objective 8.1 Technology enhanced Learning Sinapse is interested in discussing this with potential partners

Subjects of interest include:

- 1. Avanced learning analysis
- 2. Learning networks combining industry and education
- 3. Distributed learning systems
- 4. Process modeling
- 5. Curriculum development
- 6. Augmented Reality in learning



Thank you for your attention: questions are welcome

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