Supplementary Material
Optimisation Approaches for the Synthesis of Water Treatment Plants

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MILFP data discretisation

Table **??** and Table **??** present the discretisation points of pressures and operating conditions for the seawater desalination case study. Points that resulted in separation efficiencies approaching or below zero were disregarded.

Table S1: Pressure points in MILFP model, seawater desalination example

Discrete level j	**Pressure** p_{tj}							
	CF	DAF	MMF	MF	UF	NF	RO1	RO2
$j1$	0.10	0.40	0.10	0.10	0.10	0.5	5.0	5.0
$j2$	0.15	0.70	0.12	0.12	0.12	0.8	5.3	5.2
$j3$	0.20	0.40	0.15	0.15	0.14	1.0	5.5	5.5
$j4$	0.10	0.70	0.18	0.18	0.18	1.3	5.8	5.8
$j5$	0.15	0.40	0.20	0.20	0.20	1.6	6.0	6.0
$j6$	0.20	0.70	0.10	0.10	0.22	0.5		5.0
$j7$	0.10	0.40	0.12	0.12	0.24	0.8		5.2
$j8$	0.15	0.70	0.15	0.15	0.26	1.0		5.5
$j9$	0.20	0.40	0.18	0.18	0.28	1.3		5.8
$j10$	0.10	0.70	0.20	0.20	0.30	1.6		6.0
$j11$	0.15	0.40	0.10	0.10		0.5		
$j12$	0.20	0.70	0.12	0.12		0.8		
$j13$	0.10	0.40	0.15	0.15		1.0		
$j14$	0.15	0.70	0.18	0.18		1.3		
$j15$	0.20	0.40	0.20	0.20		1.6		
$j16$	0.10	0.70	0.10					
$j17$	0.15	0.40	0.12					
$j18$	0.20	0.70	0.15					
$j19$			0.18					
$j20$			0.20					
$j21$			0.10					
$j22$			0.12					
$j23$			0.15					
$j24$			0.18					
$j25$			0.20					
$j26$			0.10					
$j27$			0.12					

Table S2: Operating conditions points in MILFP model, seawater desalination example

Discrete level j	Coagulant dose cd_{tj}		Energy input gf_{tj}	Residence time tf_{tj}	Length l_{tj}	Load ld_{tj}	Media dia d_{tj}^{MED}	Temp tem_{tj}	Hydrophobicity h_{tj}	MWCO $mwco_{tj}$	pH ph_{tj}
	CF SED	CF DAF	CF	CF	MMF	MMF	MMF	MF	NF	NF	RO2
$j1$	1	1	10	5	0.5	0.5	2	20	0.002	300	8.0
$j2$	3	1	10	5	1.5	0.5	2	25	0.05	800	8.0
$j3$	4	1	10	20	2.5	0.5	2	30	0.3	1,200	8.0
$j4$	7	1	10	20	0.5	1.0	2	20	0.8	300	8.0
$j5$	10	1	10	35	1.5	1.0	2	25	1.0	800	8.0
$j6$	12	1	10	35	2.5	1.0	2	30	0.002	1,200	9.5
$j7$	13	1	120	5	0.5	1.5	2	20	0.05	300	9.5
$j8$	16	1	120	5	1.5	1.5	2	25	0.3	800	9.5
$j9$	18	1	120	20	2.5	1.5	2	30	0.8	1,200	9.5
$j10$	20	1	120	20	0.5	0.5	5	20	1.0	300	9.5
$j11$		1	120	35	1.5	0.5	5	25	0.002	800	
$j12$		1	120	35	2.5	0.5	5	30	0.05	1,200	
$j13$		20	10	5	0.5	1.0	5	20	0.3	300	
$j14$		20	10	5	1.5	1.0	5	25	0.8	800	
$j15$		20	10	20	2.5	1.0	5	30	1.0	1,200	
$j16$		20	10	20	0.5	1.5	5				
$j17$		20	10	35	1.5	1.5	5				
$j18$		20	10	35	2.5	1.5	5				
$j19$					0.5	0.5	8				
$j20$					1.5	0.5	8				
$j21$					2.5	0.5	8				
$j22$					0.5	1.0	8				
$j23$					1.5	1.0	8				
$j24$					2.5	1.0	8				
$j25$					0.5	1.5	8				
$j26$					1.5	1.5	8				
$j27$					2.5	1.5	8				

Table **??** and Table **??** present the discretisation points of pressures and operating conditions for the surface water treatment case study. Points that resulted in separation efficiencies approaching or below zero were disregarded.

Table S3: Pressure points in MILFP model, surface water treatment example

Discrete level j	**Pressure** p_{tj}						
	CF	DAF	MMF	MF	UF	NF	RO1
$j1$	0.10	0.40	0.10	0.10	0.10	0.5	3.0
$j2$	0.15	0.70	0.12	0.12	0.12	0.8	3.5
$j3$	0.20	0.40	0.15	0.15	0.14	1.0	4.0
$j4$	0.10	0.70	0.18	0.18	0.18	1.3	4.5
$j5$	0.15	0.40	0.20	0.20	0.20	1.6	5.0
$j6$	0.20	0.70	0.10	0.10	0.22	0.5	
$j7$	0.10	0.40	0.12	0.12	0.24	0.8	
$j8$	0.15	0.70	0.15	0.15	0.26	1.0	
$j9$	0.20	0.40	0.18	0.18	0.28	1.3	
$j10$	0.10	0.70	0.20	0.20	0.30	1.6	
$j11$	0.15	0.40	0.10	0.10		0.5	
$j12$	0.20	0.70	0.12	0.12		0.8	
$j13$	0.10	0.40	0.15	0.15		1.0	
$j14$	0.15	0.70	0.18	0.18		1.3	
$j15$	0.20	0.40	0.20	0.20		1.6	
$j16$		0.70	0.10				
$j17$		0.40	0.12				
$j18$		0.70	0.15				
$j19$			0.18				
$j20$			0.20				
$j21$			0.10				
$j22$			0.12				
$j23$			0.15				
$j24$			0.18				
$j25$			0.20				
$j26$			0.10				
$j27$			0.12				

Table S4: Operating conditions points in MILFP model, surface water treatment example

Discrete level j	Coagulant dose cd_{tj}	Energy input gf_{tj}	Residence time tf_{tj}	Length l_{tj}	Load ld_{tj}	Media diameter d_{tj}^{MED}	Temperature tem_{tj}	Hydrophobicity h_{tj}	MWCO $mwco_{tj}$	pH ph_{tj}
	CF	CF	CF	MMF	MMF	MMF	MF	NF	NF	CF
$j1$	10	10	5	0.5	0.5	2	20	0.002	300	3.0
$j2$	30	10	5	1.5	0.5	2	25	0.05	800	4.0
$j3$	50	10	20	2.5	0.5	2	30	0.3	1,000	5.0
$j4$	10	10	20	0.5	1.0	2	20	0.8	300	6.0
$j5$	30	10	35	1.5	1.0	2	25	1.0	800	7.0
$j6$	50	10	35	2.5	1.0	2	30	0.002	1,000	8.0
$j7$	10	120	5	0.5	1.5	2	20	0.05	300	3.0
$j8$	30	120	5	1.5	1.5	2	25	0.3	800	4.0
$j9$	50	120	20	2.5	1.5	2	30	0.8	1,000	5.0
$j10$	10	120	20	0.5	0.5	5	20	1.0	300	6.0
$j11$	30	120	35	1.5	0.5	5	25	0.002	800	7.0
$j12$	50	120	35	2.5	0.5	5	30	0.05	1,000	8.0
$j13$	10	10	5	0.5	1.0	5	20	0.3	300	3.0
$j14$	30	10	5	1.5	1.0	5	25	0.8	800	4.0
$j15$	50	10	20	2.5	1.0	5	30	1.0	1,000	5.0
$j16$	10	10	20	0.5	1.5	5			6.0	
$j17$	30	10	35	1.5	1.5	5			7.0	
$j18$	50	10	35	2.5	1.5	5			8.0	
$j19$				0.5	0.5	8				
$j20$				1.5	0.5	8				
$j21$				2.5	0.5	8				
$j22$				0.5	1.0	8				
$j23$				1.5	1.0	8				
$j24$				2.5	1.0	8				
$j25$				0.5	1.5	8				
$j26$				1.5	1.5	8				
$j27$				2.5	1.5	8				