

CEOC

Centro de Estudos em Optimização e Controlo
(Centre for Research in Optimization and Control)

ANEXO TÉCNICO

Projecto de Optimização da Diversidade e Distribuição
de Configurações de Cablagens (OPT-DDCC)

Universidade de Aveiro
Departamento de Matemática
<http://www.mat.ua.pt/investigacao/ceoc>
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Equadramento

Este projecto surge a partir dos contactos estabelecidos pelo Professor Oliveira Duarte, responsável pelo Programa Aveiro Norte, e pelo Prof. José Martinho Oliveira (Professor Adjunto da Escola Aveiro-Norte) com a Yazaki, no sentido do desenvolvimento de um projecto de colaboração com a Universidade de Aveiro para a resolução de problemas relacionados com a definição de políticas óptimas de produção de cablagens para a indústria automóvel. Tais problemas têm por base a elevada diversidade de configurações possíveis, a impossibilidade de produção atempada de todas as que são requeridas e os custos associados ao recurso a configurações subutilizadas.

Este anexo técnico visa a definição das condições, actividades, calendarização e respectivo cálculo de custos das componentes de investigação e de desenvolvimento de uma aplicação informática com vista à optimização da diversidade e da distribuição de configurações de cablagens a produzir para a indústria automóvel, de agora em diante designada por OPT-DDCC.

Descrição

Com este projecto pretende-se desenvolver uma aplicação informática (OPT-DDCC) que deverá correr em ambiente *Windows* com as seguintes funcionalidades:

1. Acesso através de um 'web browser';
2. Controlo de acessos por perfis de utilizadores;
3. Registo dos dados de entrada (ver próxima secção) por formulários web intuitivos;
4. Classificação dos dados por Cliente/Projecto/Fase com historial, a designar por cenário (CN);
5. Determinação do conjunto das n configurações de opções activas (referências) que, a partir dos dados estatísticos disponíveis, se espera serem as mais requeridas, a designar por conjunto de configurações padrão (CCP);
6. Apresentação dos resultados obtidos com os custos apurados no item anterior;

A aplicação será desenvolvida em dois módulos funcionais:

- INTERFACE - aplicação que interage com os utilizadores, manipula os dados e activa a execução do módulo SOLVER (itens 1-4, 6);
- SOLVER - aplicação que responde ao problema de optimização (item 5).

A Universidade de Aveiro deterá os direitos de autor do SOLVER, cedendo à Yazaki Saltano os direitos de livre utilização do OPT-DDCC, no âmbito das suas actividades, bem como o de aceder a futuras actualizações.

Especificação

O OPT-DDCC apresentará as seguintes entradas e saídas:

- **Entradas por cenário CN**

1. Registo de referências, opções e grupos de opções existentes;
2. Registo de custos fixos das referências e dos custos relativos à inclusão de opções na definição das diferentes configurações;
3. Registo de percentagens por opção e volume total de vendas previsto;
4. Registo de relações de obrigatoriedade e incompatibilidade entre opções;
5. Possibilidade de especificar configurações obrigatórias ou inexistentes no conjunto CCP (ex: para satisfazer necessidades de cobertura total);
6. Possibilidade de registo de dados estatísticos relativos a configurações requeridas em anos anteriores;
7. Registo de variáveis globais de configuração como o número máximo de elementos no conjunto CCP ou a percentagem mínima entre custos totais de sucessivas aproximações à obtenção do conjunto CCP;
8. Possibilidade de exportar os resultados para um formato compatível com o Microsoft Excel.

- **Saídas:**

1. Listagem das opções activas associadas a uma dada configuração (referência), com indicação dos respectivos custos;
2. Determinação do conjunto de configurações CCP e listagem das referências que pertencem a este conjunto;
3. Dados adicionais que se considerem relevantes no apoio à decisão;
4. Folha síntese com custo máximo, custo optimizado (ambos em euros e percentagem), o número de referências possíveis e o número de referências optimizado;
5. Folha com o ganho na eliminação de cada uma das referências e respectivos gráficos (euros e percentagem);
6. Matriz de referências a produzir vs grupos de opções.

Características técnicas

As ferramentas e opções técnicas escolhidas para o desenvolvimento dos módulos que compõem a aplicação OPT-DDCC foram ponderadas de forma a considerar as seguintes linhas orientadoras:

1. Independência entre o interface (módulo INTERFACE) e o algoritmo de cálculo (módulo SOLVER);

2. Eficiência e precisão na execução do SOLVER;
3. Possibilidade de reutilização do SOLVER para possíveis interações com aplicações que usem o protocolo EDI;
4. Garantir universalidade de acesso geográfico e por diferentes plataformas;
5. Permitir a vários utilizadores com interesses em diferentes subconjuntos de dados de os aceder de forma segura e intuitiva;
6. Possibilidade de migração do SOLVER da plataforma *WINDOWS* para plataformas *UNIX*;
7. Disponibilidade dos dados num Servidor de Base de Dados tornando o seu acesso possível por futuros módulos a implementar;
8. Minimizar ou eliminar custos referentes à utilização de 'code libraries', 'solvers', compiladores ou linguagens utilizando, sempre que possível, licenças 'open source'.

As características técnicas anteriormente especificadas serão obtidas com recurso às seguintes ferramentas e protocolos:

- O módulo INTERFACE será uma 'web application' implementado na linguagem ASP ou ASP.NET utilizando SQL via ODBC;
- O módulo SOLVER será uma 'CGI application' (Common Gateway Interface Application) implementado na linguagem C;
- A comunicação entre módulos será realizada através de XML (Extensible Markup Language);
- No desenvolvimento do INTERFACE será utilizado o '.NET FRAMEWORK'¹;
- Na implementação do SOLVER será utilizado o compilador de linguagem C *MINGW*² e as 'code libraries' *Expat*³ e *qDecoder*⁴;

Equipa

A equipa de trabalho para este projecto inclui os investigadores seniores do CEOC Agostinho Miguel Mendes Agra⁵, Domingos Moreira Cardoso (coordenador do projecto)⁶ e Eugénio Alexandre Miguel Rocha⁷. Adicionalmente,

¹incorporado em todos os sistemas operativos Microsoft® mais recentes ou instalável gratuitamente via 'Windows Update';

²Ver na secção de licenças, L01 para o compilador e L02 para o 'runtime';

³Licença L03;

⁴Licença L04;

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⁶Email: dcardoso@mat.ua.pt

⁷Email: eugenio@mat.ua.pt

contará também com bolsheiros a contratar (em tempo integral) para actividades de levantamento e registo de dados e de programação, os quais preencherão duas bolsas de iniciação à investigação

Desenvolvimento do projecto

O projecto de optimização da diversidade e distribuição de configurações de cablagens (OPT-DDCC) para a indústria automóvel desenvolve-se ao longo de 10 meses, segundo a calendarização a seguir indicada, em torno das seguintes actividades principais:

1. Modelação matemática e concepção algorítmica para a resolução dos problemas de optimização associados à eventual subutilização do conjunto de configurações padrão.
2. Desenho dos módulos INTERFACE e SOLVER.
3. Concepção de rotinas de tratamento de dados estatísticos.
4. Implementação da aplicação pretendida e respectivo acompanhamento, monitorização e controlo.

Tarefas

O projecto OPT-DDCC divide-se na seguinte sequência de tarefas:

1. Levantamento e registo de dados relacionados com o ambiente no qual se pretende que a aplicação a desenvolver trabalhe (LRD);
2. Refinamento da especificação do projecto, com base na informação anteriormente recolhida (REP);
3. Modelação matemática e conceptualização algorítmica para a resolução dos problemas de optimização (MM&CA);
4. Implementação das versões teste dos módulos INTERFACE e SOLVER com ajustes decorrentes das experiências a realizar (IMIS);
5. Implementação da versão final do programa de aplicação pretendido (IVF);
6. Instalação e teste da versão final do programa de aplicação pretendida (IT).

Calendarização

Meses	1	2	3	4	5	6	7	8	9	10
LRD	x	x								
REP			x							
MM&CA			x	x	x					
IMIS				x	x	x				
IVF							x	x	x	
IT										x

Cálculo de custos

Os encargos a apresentar com esta proposta pressupõem a contratação de bolsseiros de iniciação à investigação para o preenchimento de duas bolsas a tempo integral, durante 10 meses, cada uma dos quais correspondendo ao valor mensal de 745€ e a disponibilização, por parte da Yazaki, de dois computadores portáteis e de uma impressora, com características adequadas.

Tipo de Encargo	Descrição	Custo
Bolseiros	2x(745x10)	14.900,00€
Despesas Gerais	Material diverso, deslocações, etc	2.000,00€
Coordenação do Projecto	Inclui actividades de investigação	4.875,00€
Subtotal		21.775,00€
Custo do projecto	Com 20 % de overheads	27.218,75€
Total	Com 19 % de IVA	32.390,31€

Aveiro, 11 de Novembro de 2004

Domingos Moreira Cardoso
(Professor Associado da UA)

APÊNDICE - Licenças do software utilizado

Transcreve-se as licenças do software e das 'code libraries' utilizadas:

- **L01: GNU General Public License**

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