Anwendung: Partielle Redundanzelimination

Busy Code Motion (*BCM*) für...

- knotenbenannte Einzelanweisungsgraphen (kEA)
- knotenbenannte Basisblockgraphen (kBB)

Synonyme

- *UpSafety*: Availability
- *DownSafety*: Very Busyness, Anticipability

Busy Code Motion: kEA_BCM (1)

BCM for Node-labeled SI-Graphs:

1. The Up-Safety and Down-Safety Analyses

Local Predicates:

- **COMP**$_\iota(t)$: ι computes t.
- **TRANSP**$_\iota(t)$: ι does not modify an operand of t.

Busy Code Motion: kEA_BCM (2)

The Up-Safety Equation System:

$$\text{N-USAFE}_\iota = \begin{cases} false & \text{if } \iota = s \\ \prod\limits_{\widehat{\iota} \in pred(\iota)} \text{X-USAFE}_{\widehat{\iota}} & \text{otherwise} \end{cases}$$

$$\text{X-USAFE}_\iota = (\text{N-USAFE}_\iota + \mathbf{COMP}_\iota) \cdot \mathbf{TRANSP}_\iota$$

Busy Code Motion: kEA_BCM (3)

The Down-Safety Equation System:

$$\text{N-DSAFE}_\iota \;=\; \mathbf{COMP}_\iota + \text{X-DSAFE}_\iota \cdot \mathbf{TRANSP}_\iota$$

$$\text{X-DSAFE}_\iota \;=\; \begin{cases} false & \text{if } \iota = e \\ \prod\limits_{\widehat{\iota} \in succ(\iota)} \text{N-DSAFE}_{\widehat{\iota}} & \text{otherwise} \end{cases}$$

Busy Code Motion: kEA_BCM (4)

2. The Transformation: Insertion and Replacement Points

Local Predicates:

- N-USAFE*, X-USAFE*, N-DSAFE*, X-DSAFE*: greatest solutions of the down-safety and up-safety equation systems of step 1.

$$\text{N-INSERT}^{\text{BCM}}_{\iota} =_{df} \text{N-DSAFE}^{\star}_{\iota} \cdot \prod_{\widehat{\iota} \in pred(\iota)} (\overline{\text{X-USAFE}^{\star}_{\widehat{\iota}} + \text{X-DSAFE}^{\star}_{\widehat{\iota}}})$$

$$\text{X-INSERT}^{\text{BCM}}_{\iota} =_{df} \text{X-DSAFE}^{\star}_{\iota} \cdot \overline{\mathbf{TRANSP}_{\iota}}$$

$$\text{REPLACE}^{\text{BCM}}_{\iota} =_{df} \mathbf{COMP}_{\iota}$$

Busy Code Motion: kBB_BCM (1)

BCM für knotenbenannte BB-Graphen:

1. The Up-Safety and Down-Safety Analyses

Local Predicates:

- BB-NCOMP$_\beta(t)$: β contains an instruction ι computing t, which is not preceded by an instruction modifying an operand of t.
- BB-XCOMP$_\beta(t)$: β contains an instruction ι computing t, and neither ι nor any instruction of β following ι modifies an operand of t.
- BB-TRANSP$_\beta(t)$: β contains no instruction modifying an operand of t.

Busy Code Motion: kBB_BCM (2)

The Up-Safety Equation System:

$$\text{BB-N-USAFE}_\beta = \begin{cases} false & \text{if } \beta = \mathbf{s} \\ \prod_{\hat{\beta} \in pred(\beta)} (\text{BB-XCOMP}_{\hat{\beta}} + \text{BB-X-USAFE}_{\hat{\beta}}) & \text{otherwise} \end{cases}$$

$$\text{BB-X-USAFE}_\beta = (\text{BB-N-USAFE}_\beta + \text{BB-NCOMP}_\beta) \cdot \text{BB-TRANSP}_\beta$$

Busy Code Motion: kBB_BCM (3)

The Down-Safety Equation System:

$$\text{BB-N-DSAFE}_\beta = \text{BB-NCOMP}_\beta + \text{BB-X-DSAFE}_\beta \cdot \text{BB-TRANSP}_\beta$$

$$\text{BB-X-DSAFE}_\beta = \text{BB-XCOMP}_\beta + \begin{cases} false & \text{if } \beta = \mathbf{e} \\ \prod_{\widehat{\beta} \in succ(\beta)} \text{BB-N-DSAFE}_{\widehat{\beta}} & \text{otherwise} \end{cases}$$

Busy Code Motion: kBB_BCM (4)

2. The Transformation: Insertion and Replacement Points

Local Predicates:

- BB-N-USAFE*, BB-X-USAFE*, BB-N-DSAFE*, BB-X-DSAFE*: greatest solutions of the up-safety and down-safety equation systems of step 1.

$$\text{N-INSERT}^{\text{BCM}}_{\beta} =_{df} \text{BB-N-DSAFE}^{\star}_{\beta} \cdot \prod_{\hat{\beta} \in pred(\beta)} (\overline{\text{BB-X-USAFE}^{\star}_{\hat{\beta}} + \text{BB-X-DSAFE}^{\star}_{\hat{\beta}}})$$

$$\text{X-INSERT}^{\text{BCM}}_{\beta} =_{df} \text{BB-X-DSAFE}^{\star}_{\beta} \cdot \overline{\text{BB-TRANSP}_{\beta}}$$

$$\text{N-REPLACE}^{\text{BCM}}_{\beta} =_{df} \text{BB-NCOMP}_{\beta}$$

$$\text{X-REPLACE}^{\text{BCM}}_{\beta} =_{df} \text{BB-XCOMP}_{\beta}$$

Sparse Code Motion

...platzsensitive partielle Redundanzelimination:

Anhand von Vorlesungsteil 7!

Vorschau: Letzter Vorlesungstermin...

- Di, 30.01.2007, Vorlesung von 17:45 Uhr bis 19:15 Uhr, Bibliothek E185/1