

8][]hU`Yg';]dZY`ViW\'Ua'>YbbYf. 9f`YVb]ggY'a]h'EF!7cXYg'ZYgh\U`hYb°

6Ygi WXYf'XYg'≯bbYf']b'6YfWXhYg[UXYbYf'@UbX'_ÒbbYb'UV gcZcfh']\fY'9f`YVb]ggY'X][]hU`'j]U'EF!7cXY']a 'bYi Yb ;]dZY`Vi WX'ZYgh\U`hYb"



6YfWk hYg[UXYbž8Yi hgWk`UbX'!'\delta\6YfWk hYg[UXYbž'Ua
VYY]bXfi W_YbXYb'\delta\bYfzk]fX'Yhnh'Ui Z'Y]b'X][]hU`Yg';]dZY`Vi Wk
i a [Ygh]Y[Yb''8Yf'GWkf]hh']gh'HY]`'Y]bYf'a cXYfbYb'\delta\b]h]Uh]j Yž'X]Y
Yg'XYb'6Ygi WkYfb'Yfa O[`]Wkhž']\fY'gWk\ObghYb'\9f`YVb]ggY'Ua
;]dZY``nY]h[Ya À\delta\angle ZYghni\U`hYb''\5b'nkY]'j YfgWk]YXYbYb'GhY``Yb'
XYa 'VY`]YVhYb'?\Ob][gV`]W_'i bX'XYa 'GcW_Y``XYg']_cb]gWkYb
\delta\bYbYf!;]dZY`_fYi nYg' '_\ObbYb'k UbXYfZfYi X][Y'; AghY'Y]bZUWk
Y]bYb'EF!7cXY'gWUbbYbž'i a ']\fY'dYfgOb`]WkYb'; YgWk]WkhYb'i bX
9]bXfØW_Y'Ui Z'XYf'K YVg]hY'XYf'\dYbbYfVU\b'Y]bni hfU[Yb''8]YgY
X][]hU`Y'@Ogi b['k]fX'j cb'XYf'6YfWkhYg[UXYbYf'6Yf[VU\b'5;
j cf[YghY``h'i bX'[`Y]Wkh'XYb'<YfUi gZcfXYfi b[Ybž'X]Y'X]Y'\c\Y
6Ygi WkYfZfYei Ybn'a]h'g]Wk'Vf]b[h''

$9f\U^{x}f'HfUX]h]cb']b'X][]hU`Yf': cfa$

HfUX]h]cbY``Y';]dZY`VØW\Yfž'X]Y'cZh'k YhhYfZYgh'i bX'[YgW\Øhnh']b6clYb'Ua';]dZY`_fYi n'Ui ZVYk U\fh'k YfXYbž'\UVYb']\fY'[UbnY][YbY'; YgW\]W\hY''8cW\j]Y`Y'BcghU`[]_Yf'j Yfa]ggYb'X]YdYfgÒb`]W\Y'BchY'i bX'X]Y'\UbXgW\f]Zh`]W\Yb'9]bhf\[A[Yž'X]Y'gc`W\Y]b'6i W\Y]bn][Ufh]['a UW\Yb''8]YgYg'; YZØ\``_ObbhY'VY]'Y]b][Yb6Ygi W\Yfb'Ui Z'XYf'GhfYW_Y'V`Y]VYbž'k Ybb'g]Y']\fY'9f]bbYfi b[YbYhnh'bi f'bcW\X][]hU`'ZYgh\U`hYb'_ObbYb'''8YbbcW\V]YhYhX]YbYi Y'X][]hU`Y'@Ogi b['XYb'JcfhY]`ž'XUgg'g]Y''YXYfnY]h'i bX'ØVYfU``ni [\[Ab[`]W\]']gh'i bX'_Y]bY'DfcV`YaY'Xi fW\'k YW\gY`bXYKYhYfj Yf\[A`hb]ggY'YbhghY\Yb''

 $\label{eq:local_stress_stres$

8][]hU`Y'5bgÀhnY'i bX'BUhi fgW\i hn

9]b'k Y]hYfYf'6`]W_k]b_Y`'Ui Z'X]Y'8][]hU`]g]Yfi b['`]YZYfh'XYf'J cfhfU[j cb'7\f]gh]Ub'GW\bY]XYf'i bX'A Uf`Yb'8Uj]g'ØVYf'X]Y'DchYbn]U`Y

XYf'8][]hU`]g]Yfi b[']a 'BUhi fgWi hn"8]YgYf'H\Ya YbgWk Yfdi b_h nY][hžXUgg'X]Y'8][]hU`]g]Yfi b['b]Wkh'bi f'9]bni [']b'i bgYfY

: fY]nY]hU_h]j]hÀhYb'\À`hžgcbXYfb'Ui Wk'k]Wkh][Y': i b_h]cbYb']a
6YfY]Wk 'BUhi fgWki hn'i bX'XYf'9f\U`hi b['V]c`c[]gWkYf'J]Y`ZU`h
YfZØ``h"'8]Y'9f_Ybbhb]ggY'Ui g'XYa 'JcfhfU['j YfXYi h`]WkYbž'k]Y
X][]hU`Y'5bgÀhnY'Ui Wk'ni f'gcn]U`Yb'i bX'Ò_c`c[]gWkYb
HfUbgZcfa Uh]cb'j cb'; YgY``gWkUZh'i bX'K]fhgWkUZh'VY]hfU[Yb
`ObbYb"'8]Y'JYfV]bXi b['j cb'HYWkb]'i bX'BUhi f']gh'Y]bY
<YfUi gZcfXYfi b[ž'XYf'k]f'i bg'U``Y'ghY``Yb'a ØggYb"

#bg[YgUa hi]ghiXYfiGWkf]hhini iY]bYa iX][]hUiYb;]dZYiVi WkiUa
*/bbYfib]Wkhibi fiY]biNY]WkYbiXUZØfžiXUggig]WkiUi WkiUihY
HfUX]h]cbYbik UbXYibžigcbXYfbiUi WkiY]bi6Y]gd]YiiXUZØfžik]Y
X][]hUiYiHccigig]bbj ciii[Ybi hnhik YfXYbi_ObbYbžii a iBUhi fii bX
9f]bbYfi b[Ybia]hY]bUbXYfini ij YfV]bXYbii8UgiX][]hUiYi;]dZYiVi WkiAXhiUiiYi6Ygi WkYfiY]bžiHY]iiX]YgYfibYi Ybii cfa iXYgi9f]bbYfbgini
k YfXYbii bXiY]bYbi6Y]hfU[ini iXYbi; YgWk]WkhYbiXYgi¾bbYf[]dZYig
ni iiY]ghYbii

8 YhU]`g	
Cfh	6YfWN, hYg[UXYbž'8YihgWN,`UbX
EiY``Yb	• kkk"giYXXYihgWXY"XY
	• k k k "dbd"XY
	• j]XYc[c`X"XY

6 Ygi WX Yb G]Y i bg Ui Z bU[!VUmYfb"XY