Design and Synthesis of PID Controller Based on Fuzzy

OF CUI CDKWN'KUNCO³.PQY UI CF 'CO KP⁴. 'O WMVGT'\ CO CP³. 'O CUDJ W CP^{3"} Hcewn/{ "qh'Gpi kpggtkpi 3."F gr ctvo gpv'qh'Grgevtkecn'Grgevtqpke"cpf "U{ uvgo "Gpi kpggtkpi " ('Uqrct'Gpgti { 'Tgugctej 'Koukwwg⁴" O wnko gf kc "Wpkxgtukx{3. "Wpkxgtukx{"Mgdcpi uccp"O cm {ukc4" 85322'E{dgtlc{c."Ugrepi qt³."65822"WMO."Depi k"Ugrepi qt⁴" OCNC[UKC^{3.4"}

Abstract: - Vj ku" r cr gt" f guetkdgu" vj g" j ctf y ctg" ko r ngo gpvcvkqp" qh" c" RKF/v{r g" *Rtqr qt vkqpcn/" Kpvgi tcn!/ F gtkxcvkxg+"Hw| | {"Nqi ke"Eqpvtqngt"*HNE+"cri qtkj o "wukpi "XJ F N"vq"wug"kp"vtcpur qtvcvkqp"etwkukpi "u{ uvgo 0' Vj g"etwkukpi "u{ uvgo "j cu"f gxgrqr gf "vq"cxqkf "vj g"eqrrkukqpu"dgw ggp"xgj kergu"qp"vj g"tqcf 0'Vj g"RKF/v{r g"HNE" rtqxkf gu"c"tghgtgpeg"hqt"c"ect"vq"gkij gt"kpetgcug"qt"f getgcug"vj g"ur ggf "qh"vj g"xgj keng"f gr gpf kpi "qp"vj g"f knvcpeg" qh" yj g"r tgegf kpi "xgj kerg" y j gp"kv" i gwu"vqq" emqug" qt" crgt v" yj g"f tkxgt" y j gp" pgeguuct {0'Vj g"RKF/v{r g"Hw| | {" Eqpvtqngt"cn qtk.j o "ku"hktuv"f gxgnqr gf "wukpi "O cvrcd"r rcvhqto 0'Vj g"O co f cpk"Hw| | { "Kohgtgpeg"ku"uwf kgf "cpf" crrnkgf "vq"f guki p"vj g"RKF/v{rg"Hw| | {"eqpvtqngt"j ctf y ctg"u{uvgo 0"Vj g"eqpvtqngt"u{uvgo "vj gp"ku"ko rngo gpvgf" wulpi "XJ F NO'Vj g"u{pyj gulku"vqqn"S wctwwu"KKku"wugf "vq"u{pyj gulkţ g"yj g"XJ F N"eqf gu"vq"qdvclp"yj g"Tgi kuvgt" Vtcpuhgt"Ngxgnt*TVN+"xkgy "qh"vjg"HNE"jctfyctg0"Vjg"oqvkxcvkqp"kp"fgukipkpi"ku'vjg"Hw\|{"dcugf"RKF"etwkukpi" eqpvtqmgt"ku"ej gcr gt"eqpvtqmgt"kp"equv'eqo r ctg"vq"""eqpxgpvkqpcn"RKF "eqpvtqmgt"u{uvgo "cpf"vj wu"o cmg"kv" cxckrcdrg"\q"yj g"gpvt{/rgxgrlxgj kergu"uwej "cu"\yj g"pc\kqpcrl"ect0"Vj ku"ecp"dg"hwtyj gt "tgf wegf "\yj g"tqcf "ceekf gpv"cpf " gpuwtg''y g'uchgv(''qh''y g'tqcf ''wugtu'kp''y g'hwwtg0"'

Key-Words: - RKF "cni qtkij o . "XJ F N. "Hw | { . "U{pyj guki"

1 Introduction

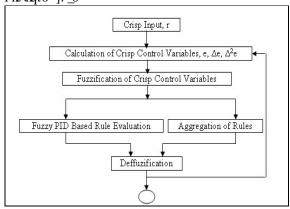
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F gtkxcvkxg+"v{r g"cu"r tqr qugf "d{"O co f cpk"|7 0"Vj ku" ku"dgecwug"yi g"yi tgg/kpr wu"qh"RKF "eqpvtqmgt"ctg"c" eqo r mgz" vcum" cu" o qtg" r ctco gvgtu" j cxg" vq" dg" eqpulf gtgf "lp"dwlrf lpi "yj g"hw| | { "twrg"dcug"]8_0'K'lu" f khhkewn/" vq" f gvgto kpg" vj g" eqpvtqn" twrgu" hqt" vj g" Kovgi ten'o qf g"kor wy'*Ûg+."cu"yj g"uvgef { "uvevg"gttqt" qh"c"u{uvgo "ku"xgt{"j ctf "vq"f ghkpg"]8_0'Vj gtghqtg." yj g''yj tgg''kpr wu''qh''yj g''eqpvtqngt''ctg''f ghkpgf ''cu''gttqt'' *g+." ej cpi g" kp" gttqt" *ê g+" *cnuq" mpqy p" cu" F gtkxcvkxg+."cpf "vj g"tcvg"qh"ej cpi g"qh"gttqt"*ê 4g+" *cnuq"mpqy p"cu"ceegngtcvkqp"gttqt+."]8_0'Dgukf gu"kv." yj gtg"ku"pq"r tqr gt"y c{"qh"wpkpi "o gyj qf "cxckrcdrg" wpvkn'pqy 0'Vtkcn/cpf/gttqt'\wpkpi "o gyj qf 'ku'tgs wktgf" kp"qr vko k kpi "yj g"eqpvtqmgt"]9_0'"Hvtyj gto qtg."yj g" pwo dgt"qh'twrg"dcug"kpet gcug"gzr qpgpvkcm("y kij "vi g" kpetgcug"qh"o go dgtuj kr "hwpevkqp"]9_0'Kb"yj g"pwo dgt" qh" kpr w'' ku" m." cpf " yj g" pwo dgt" qh" o go dgtuj kr " hwpevkqp"hqt"gcej "kpr wi'ku"n."vj gp"vj g"vqvcn'pwo dgt" qh'y g'KH/Gnug't wrgu'ku'gs wen'vq'mⁿ."

"""Vj g"tguv"qh"vj g"r cr gt"ku"qti cpk gf "cu"hqmqy u<" Ugevkqp"4"f guetkdgu"vj g"RKF "v{r g"hw| | { "eqpvtqmgt" cni qtkij o 0' Ugevkqp" 5" rtgugpvu" yj g" O CVNCD" uko wrcykap"tguwn0'O qf grkpi "qh"vj g"eqpytamgt"wukpi " XJ F N"ku"f guetkdgf "kp"ugevkqp"60"Ugevkqp"7"r tgugpvu" y g" eqo r ctkuqpu" dgw ggp" O CVNCD" cpf " XJ F N" uko wrcykap 'tguwnwo'Ugevkap '8 'r tgugpvu' yi g'U{ pyi gukuo' Hkpcm{."eqpenwukqp'ku'ftcyp'kp'yjku'rcrgt()

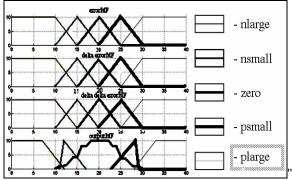
2 PID controller with fuzzy algorithm

 $\label{eq:ctv'qh'RKF} \textit{V}_{1} \text{ g''hw} \mid \text{g''hw} \mid \text{g''} \text{hw} \mid \text{g''} \text{h$ eqpvtqngt" cni qtkyj o " hqt" ko r ngo gpvkpi " RKF/v{r g" HNE"j ctf y ctg"f guki p0"Vj g"etkur "kpr wu"qh"vj g"RKF" hw | {" eqpvtqmgt" j cxg" eqo r wgf " kp" O CVNCD" r nexhqto "]: _0"



Hki 0' 3" Hrqy " ej ctv' qh" RKF /v{r g" hw| | { " eqpvtqmgt" cni qtkyj o 0'

""""Kp''yj ku''uko wrcvkqp''uvci g''yj g''o go dgtuj kr 'hwpevkqp'' qh"yi g"eqpvtqmgt"ku"uj khvgf "42"uvgr u"vq"yi g"r qukskxg" ulf g"cpf "vj g"ugvr qkpv' ku" 42" *cewcn' ugvr qkpv'? "2+0' Vj gtghqtg." yj g" etkur" kpr w\" ku" uj khvgf " 42" uvgr u" vqy ctf u'vj g'r qukkx g'ukf g''cu''y gm0'Cu''cp''gzco r rg''qh'' yj g'kpr w''qh'/8."yj g'kpr w'tgcf ''d{ ''yj g'' eqpvtqngt 'ku'*/ 8"- "42+"? "360'Hki 0'4" uj qy u" yj g"Kpr w''cpf "qwr w'' o go dgtuj kr 'hwpevkqp"qh'RKF/v{rg'Hw| | { 'Eqpvtqmgt0'



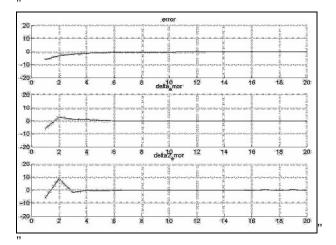
Hki 0'4 Kpr w''cpf "qwr w''o go dgtuj kr "hwpevkqp"qh" RKF/v{rg'Hw||{'Eqpytqmgt"

Vj g"vj tgg"kpr wu"qh"vj g"Hw| | {"RKF "eqpvtqmgt"ctg" ecrewrcygf "hqt" 'y g"hqmqy kpi "xctkcdrg" uvci gu<

- 30 Gttqt'kpr wi'? 'etkur 'kpr wi''
- 40 F gnc "gttqt" kpr wi"? "ewttgpv "gttqt" / "r tgxkqwu""
- 50 F gnc4" gttqt" kpr w''?" ewttgpv'' f gnc'' gttqt"/" r tgxkqwu'f gnc'gttqt'''

Matlab simulation results

Hki 0'5"uj qy u"yj g"O CVNCD"uko wreskqp"tguwn/'hqt" gttqt"*g+."f gnxc"gttqt"*ê g+."cpf "f gnxc4"gttqt"*ê 4g+0' Htqo "yi g"eqo r ngvg"uko wrcvkqp"tguwnv"qh"gttqt"*g+."kv" ecp"dg"qdugtxgf "vj cv'vj g"xcnwg"qh"gttqt"ku'tgf wegf "vq" | gtq"y j gp"yj g"Hw| | {"r tqeguu"ku"hwtyj gt"crrnkgf "vq" yj g"qwxr ww0"'



Hki 0"""5<'O CVNCD"uko wrcvkqp"tguwnx"lpkskcn'gttqt"?" /8"

4 Modeling of PID controller using VHDL

Vjg" dgjcxkqt" qh" RKF/v{rg" Hw||{" eqpvtqmgt" cni qtkij o "hqt" f guki pkpi " c" j ctf y ctg" u{uvgo " j cu" f gxgmr gf "wukpi "XJ F N"repi wei g0""Vj g"f gxgmr gf " eqf g"kp"XJ F N"ku"wugf "vq"r gthqto "hqwt"O co f cpk" Hw | { 'kpygthceg'r tqeguugu'cu'y gm0'kp''vi ku'uvgr .''vi gtg'' ctg"ukz"o qf wrgu"qh"RKF "eqpvtqrrgt"*k0"Hw| | khkecvkqp<" fgitggavtwij0xjf." cpf" ewOH0xjf." kk0' Twrg" Gxcnvcvkqp<"twgadcug0xj f."cpf "twgaf gi tgg0xj f."kkl0" Ci i tgi cvkqp" twnu" cpf "Fghw | khkecvkqp<" EQI 0xj f." cpf " kx0' qpg" xctkcdrg" ecrewrckqp<' xctaecr0xj f " +'" drqem" j cxg" dggp" ecttkgf " qw" hqt" ko r ngo gpvkpi " j ctf y ctg" f guki p0' Vj g" cdqxg" ukz" o qf wrgu" ctg" eqo dkpgf " vqi gyj gt " kpvq " yj g " eqpvtqmgt " wpkv" *eqpvtqmgt(kj f+" vq" r gthqto " yj g" hqwt" O co f cpk" Hw | { "Kohgtgpeg"r tqeguugu0Vj g"xctaecr0xj f "o qf wrg" kı"wugf "vq"ecnewrcyg"yi g"yi tgg"etkur u"kpr wuu"qh"yi g" $RKF/v\{rg''Hw\} \mid \{'Eqpvtqmgt''U\{uvgo\ 0'\}\}$

"""Vjg" Ewttgpvaf gncagttqt" ku" gs wcn' vq" vjg" f khhgtgpeg" dgw ggp" vjg" kpr w" cpf " qrf agttqt" r kpu" y j gtgcu" yi g" Ewttgpvaf gnc⁴a gttqt" ku" gs wcn' vq" yi g" fkhhgtgpeg" dgw ggp" yj g" qrf agttqt" cpf " yj g" qrf af gncagttqt0P gzv."vj ku"o qf wrg"y km'dg"hggf dcem' y g" Pgzvaqnf agttqt" cpf " Pgzvaf gncaqnf agttqt" qwr w'\q'Qnf agttqt"cpf 'Qnf af gncagttqt "cv'\j g'kpr w' tgur gevkxgn('hqt''yi g''xctkcdrg''ecrewrcvkqp''qr gtcvkqp0'''

""""Vjg" Hw| | khlecvkqp" uvgru" jcxg" eqorwgf "ykj' yj tgg"etkur "kpr wu" wukpi "yj g" f gi tgga vtwyj 0xj f "cpf" ew/O H0xj f " o qf wrg" vq " r gthqto " yj g" hw | khlecvkqp" vcuntVj g'f gi tgga vtwj (xj f "o qf wrg'ku'f gvgto kpgf "vj g" kpr w'o go dgtuj kr 'hwpevkqp''dcugf ''qp''etkur ''kpr w0Qp'' yj g"qyj gt"j cpf."ewO H0xj f "o qf wrg"f gvgto kpgu"yj g" kpr wi' o go dgtuj kr "hwpevkqp" yj cv' kpxqnxgu" eqttgur qpf kpi "\q"gcej "qh"\j g"f gi tgg"qhxtwj 0"Vcdrg"3" uj qy u"yj g"qwr w"qh"gcej "qh"yj g"f gi tggavtwj 0xj f" cpf "ewO H0xj f 0"

Vcdrg'3<'Qwr w'qh'gcej 'qh'y g" f gi tggavtwj 0xj f "cpf "ewO H0xj f "3<"

	O qf wn		Qwr w'qh
	g"	degree_truth.v	cutMF.vh
ı		hd"	d"
	3"	F3.'F4"	O 3.'O 4"
	4"	F5.'F6"	05.'06"
	5"	F7.'F8"	O 7.'O 8"

Vj g"twrgadcugf (xj f "o qf wrg"ku" wugf "vq" f gvgto kpg" yj g" qwr wi' o go dgtuj kr " hwpevkqp" qp" kuu" kpr wi' o go dgtuj kr "hwpevkqp" htqo "ewO H0xj f "o qf wrg0' Ukpeg"yj g"vqvcn'pwo dgt"qh'twrgu''kpxqnxg"ku"gs wcn'vq" 4⁵"?": ."yj gtghqtg"gki j v"twrgadcugf 0xj f "o qf wrgu"ku" pggf gf "vq"r gthqto "gcej "qh"yj g"twrg"dcug"qr gtcvkqp0' Dgukf gu." yj g" f gi t gg" qh" vtwj " qh" yj g" kpr w' o go dgtuj kr " hwpevkqp" hqwpf " d{ " f gi tggavtwj 0xj f " o qf wrg"ku"õcpf gf ö"vqi gyj gt "vq"qdvckp"yj g"o kpko wo " xcnwg" qh' qwr w' o go dgtuj kr " hwpewlqp0' Vcdrg" 4" uj qy u''yj g''eqo r ngvg''qr gtcvkqp''qh''twrgadcug0xj f ''cpf'' twgaf gi tgg(kj f 'kp'gcej 'hw| | { 'kphgtgpeg'e{erg()'

Vcdrg'4<Eqo r rgvg''qr gtcvkqp''qh'twrgadcugf 0xj f'' o af wrgu'ko "gcei 'hwl | { "kohgtgpeg"e { erg"

o di miguri geej im i i migigpeg e i eig				
Twngadcug	"Kpxqnxgf"	Qwr w'	F gi tgg"qh'\twj "	
Oqf wrg"	Kpr w.''	o go dgtuj kr	"qh'qwrw'	
	o go dgtuj kr	"hwpevkqp"	o go dgtuj kr"	
	hwpevkqp"		hwpevkqp"	
3"	O 3.'O 5.O 7	" D3"	Olp*F3.F5.F7+	
4"	O 3.'O 5.O 8	' D4"	O kp*F3.F5.F8+	
5"	O 3.'O 6.O 7	" D5"	O kp*F3.F6.F7+	
6"	O 3.'O 6.O 8	" D6"	O kp*F3.F6.F8+	
7"	O 4.O 5.O 7'	D7"	O kp*F4.F5.F7+	
8"	O 4.'O 5.O 8	" D8"	O kp*F4.F6.F8+	
9"	O 4.'O 6.O 7	" D9"	O kp*F4.F6.F7+	
:"	O 4.'O 6.O 8	' D: "	O kp*F 4.F 6.F 8+	

Hkpcm(."vj g"EQI 0xj f "o qf wrg"ku"qr gtcvgu"dcugf "qp" Ciitgicvkqp" qh" Twrgu" cpf "Fghw| khlecvkqp ceeqtf kpi n{0'''Kp"ci i tgi cvkqp"twrg."cm'yj g"qwr w''qh" twrg"gxcnwcykqp"ku"eqo dkpgf "vq"hqto "c"ukpi rg"Hw| { " ugv0'"Vj g"qwr wv'qh"ci i tgi cvkqp"qh"twrgu"ku"c"ugv'qh"

r quukdrg"et kur "qwxr w0'J qy gxgt."c"wpks wg"xcnwg"ku" pggf gf "vq"dg"f gvgto kpgf "cv"yj g"hkpcn"qwr wv"qh"yj g" eqpvtqmgt0"

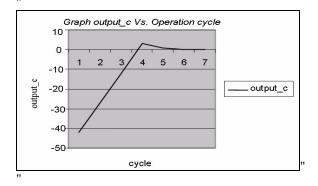
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"gttqt"*g+"f gnxc"gttqt"*ê g+."cpf " f gnxc⁴"gttqt"*ê ⁴g+"tgur gevkxgn{0'Vj g"qwr wae"ku"yj g" qwr w" qh" yj g" eqpvtqngt" yj cv" tgr tgugpvu" yj g" pgy " gttqt" chygt" yjg" Hw||{" Kphgtgpeg" rtqeguugu0" P gzagttqt"cpf "pgzaf gnc"ku" yj g"ewttgpv"gttqt"cpf " f gnxc" gttqt" xcnxg." y j kej "y km' dg" hgf "dcem' vq" qnf " gttqt"cpf "qrf "f grxc"gttqt"tgur gevkxgr | "hqt" y g"pgzv" eqpvtqmgt"qr gtcvkqp0'Vj g"P wo ae"cpf "f gpae"ctg"hqt" o qpkqt"r wtr qugu"qpn{ ."y j kej "cmqy u"yj g"qwr w''qh" Ci i tgi cvkqp"qh"Twrgu"qh"gcej "e{erg"hqt"ecrewrcvkpi " o cpwcm(0' Dgulf gu" kv." yj g" qwr wae" ku" r mwgf " vq" qdvckp"yj g"i tcr j kecn'xkgy "qh"yj g"qr gtcvkqp"qh"yj g" RKF 'eqpytqmgt'u{ uvgo 0'

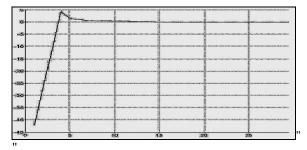
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Comparison results in MATLAB and VHDL

Dqyj "yj g"O CVNCD"cpf "XJ F N"uko wreskqp"tguwnu" o ggv"yj g"ur gelthlecvkqp"qh"RKF/v{rg"HNE"u{uvgo "hqt" f guki pkpi "XNUK ej kr " cpf " yj g" cni qtkyj o " ku" cnıq" tgf wegu" yj g"gttqt" vq" | gtq0'J qy gxgt." yj g"cni qtkyj o " vcngu"yi g"f khhgtgpv'r cyi u"vq"cej kgxg"yi g"| gtq"r qkpv0' Hki 0'6''cpf "Hki 0'7''uj qy u''vj g''XJ F N''uko wrcvkqp''r rqvu'' cpf "o cvrcd" vq "eqo r ctg "y gkt "eqghhkekgpv" tgur gevkxgn{0'



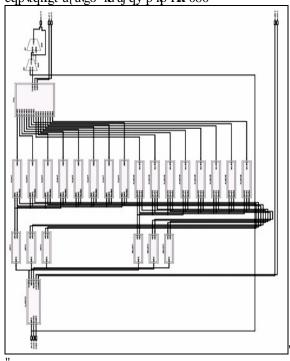
Hki 0'6'XJ F N'uko wrevkqp'r myv'hqt'kpksken'gttqt"? "/64"



Hki 07'O CVNCD'uko wrcykąp'r myżhąt'kpksken'gttąt''? "/

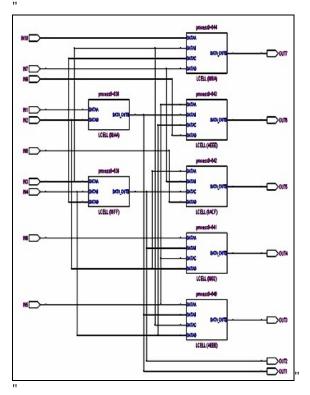
6 **Synthesis**

U{pyj guku" ku" yj g" r tqeguu" qh" vtcpuhqto kpi " qpg" tgr tgugp vc vkqp"kp"vj g"f guki p"cduvtce vkqp"j kgtctej {"vq" cpqyj gt" tgrtgugpvcvkqp0' U{pyj guku" rtqeguu" j cu" r gthqto gf "wukpi "u{pyj guku"vqqnu" *S wctwu "KK+" hqt" u{pyj gukļ kpi "yj g"eqo r krgf "XJ F N"f guki p"eqf gu'kpvq" i cvg" rgxgn" uej go cvleu0' Kl" kpkskcm(" rtqeguugu" vj g" XJ F N"dwkrf kpi "drqemu"vq"Tgi kuvgt "Vtcpuhgt"Ngxgn" *TVN+"dmem'hqt"cm'ukz"j ctf y ctg"o qf wrgu"qh'RKF" eqpvtqmgt"u{uvgo 0""Vj g"eqo r qpgpvu"qh"o qf wrgu"ctg" uwej "cu" o wnkr nkgt. "tgi kuvgtu. "i cvgu" cpf "hrkr/hrqr u" gve0'Y j krg" u{pyj gukl kpi "yj g" f guki p."J F N" rkdtct{" dtqy ugt" y cu" wugf " vq" u{ pyj gukţ g" yj g" f guki p" kp" c" j kgtctej kecn' o cppgt0' " Kp" vj ku" r cr gt." y g" j cxg" rtgugpvgf "qpg" qh" yj g" TVN" drqemu" co qpi "qh" ukz" o qf wrgu0' Vj g" TVN" xkgy " qh" RKF/v{rg" Hw}| { " eqpvtqmgt 'u{ uvgo 'ku'uj qy p'kp'Hki 080'



 $Hki 08 < TVN'xkgy 'qh'RKF/v(rg'Hw) | { 'Eqpvtqmgt''}$ U{uvgo "

*GR42M422GHE6: 6/4Z+" r centri g" vq" i gv" vj g" vgej pqnqi {"xkgy "qh"yj g"xctkqwu"o qf wrgu"qh"RKF/ v{rg"Hw| | {"Eqpvtqmgt"ej kr0'Cu"cp"gzco r mg."qpg"qh" vgej pqnqi { "xkgy u"qh"vj g"RKF/v{rg"Hw| | { "Eqpvtqngt" o qf wrgu'u{ uvgo 'ku'uj qy p'kp'Hki 090'



 $Hki 0' 9 \stackrel{<}{<} Vgej pqnqi { "Xkgy "qh" RKF/v{rg" Hw| | { "}}$ eqpvtqmgt 'U{ uvgo 0*Xctaecn'o qf wrg+"

8 Conclusion

 $\label{eq:continuity} Vj~g"~R\mbox{KF}~"~v\mbox{r~g"~hw}|~\{"~eqpvtqngt"~cni~qtkj~o~"~j~cu"~f~guetk\mbox{dgf}"~h\mbox{$ktuv"$}~wu\mbox{kpi} i"~O~CVNCD"~r~cv\mbox{$hqto$} o'~Vj~g"$ f guetkdgf "RKF" eqpvtqmgt "cnuq" j cu" f gxgmqr gf "y kyj " cm' hw | { "twrgu" hqt "f guki pkpi " yj g" j ctf y ctg" ej kr " wukpi "XJ F NO'Vj gp."yj g"u{ pyj gukt g"\qqn"j cu"wugf "\q" i gv'yj g'hqi ke'i cvg"qh'j ctf y ctg"o qf wrgu"hqt "RKF "V(rg" Hw | { "eqpvtqmgt"ej kr 0"

""""Vj g" u{pyj gukţ gf " eqf gu" y km' dg" hkpcm{" f qy prącf gf " kp yq " yj g" HRI C" dąctf " yq" yguv" ku" hwpevkqpcrkv{"vq"gpuwtg"yjcv"yjg"jctfyctg"qh"yjg" RKF/v(rg"Hw| | { "Eqpvtqngt"y qtm"eqttgevn('kp"hwwtg0' Vj g"eqpvtqmgt"cni qtknj o "y km'dg"hwtyj gt"qr vko kt gf" d{"ko r tqxkpi " yi g" o go dgtuj kr "hwpevkqp." yi g" twrg" dcug. "cpf "yj g"wpkpi "o gyj qf 0'KV'uj qwrf "dg"f qpg"vq" qdvclp"dgwgt"eqpvtqn"qxgt"ku"crrnkecvkqp"dgecwug" yj gtg" ctg" o cp{" eqpuvtckpvu" yj qug" pggf u" vq" dg" eqpulf gtgf "kp" yj g"tgcn'y qtrf "cpf "vq"gpuwtg" yj g"uchgv{" qh'y g'tqcf 'wugt'kp'y g'hwwtg0"

References:

3_O kej ckil Rgvtqx." Kxcp" I cpej gx." Mtwo " Mwt {cpunk "C"uwf { "qp" yi g"Hw | { "RKF "Eqp tqmgt." Eqpvtqn"U{uvgo "F gr ctvo gpv."Vgej plecn"Wplxgtulx{" Ughkc"

14 Ft0' O 0' L0' Y kmku" *3;;:." Pqxgo dgt" 39+0' Rtgr gt kgpcn/Kovgi tcn/F gtkxcvkxg"Egpvtqn0']Opnkog 0' Wpkxgtukv{ ''qh'P gy ecuvrg0'

]5_M0'U0' Vcpi ."Mko "Hwpi "O cp."I wcptqpi "Ej gp." Uco "My qpi ." Cp" Qr vko cn' Hw | { "RKF "Eqpvtqngt0' KGGG"Vtcpu0'qp"Kof 0'Grgevtqpkeu."Xqr0'6: ."Cwi wuv" 42230'

]6 "Ft0'Tgppgt"*Pq"Fcvg+0'Hw| | { "Gzrgtv"U{uvgo < Hw | { "Nqi le0']Qprlpg_"Ecrllqtplc"Uvcvg"Wplxgtulx{0' j wr <1 v v OgeunO' euwej kegOgf wl¢tgppgt IVgcej kpi 1" 345 lNgewtgulpgi pgxkum [1"]4227."42"Lwpg_0

]7_" Ft0' O 0' L0' Y kmku" *3; ; : . " P qxgo dgt" 39+0' Rtqrqtvkqpcn/kovgi tcn/F gtkxcvkxg"Eqpvtqrf0']Qprkpg_0' Wpkxgtukx{" qh" P gy ecuvrg() wr <1 lrqt kgp()pen()ce()vm1" o kpi lrkf lRKF 0 f h%ugctej?)RKF' 42r f h)04228_0'

18 'I gqti g'MOKOO cpp. 'Dcq/I cpi 'J w.'Tc{o qpi 'I 0' I qukpg." Cpcn{uku" qh" Fktgev" Cevkqp" Hw | {" RKF" Equiptqmgt" Untwewtg0' KGGG" Vtcpu." qp" U{uvgo u." Ocp. "cpf" E{dgtpgvkeu"/"Rctv" D<" E{dgtpgvkeu." Xqrf)" 4; .'Pq05.'Lwpg'3; ; ; 0'

]9_'Dcq/I cpi 'J w.'I gqti g'M0K0O cpp.'Tc{o qpf 'I 0' I qukpg." C" u{uvgo cvke" Uwf{" qh" Hw||{" RKF" Eqpvtqmgtu'o''Hwpevkqp/Dcugf 'Gxcnwcvkqp''Crrtqcej 0' KGGG" Vtcpu0' qp" Hw | {" U{uvgo ." Xqn0' ; ." Pq07." Oevqdgt'42230'

"]: _'Eqpvtqri"Vwqtkcrihqt"O CVNCD0**P q'F cvg+0'RKF" Vwqtkcn0']Qprkpg_0' Wpkxgtukv{" qh" O kej ki cp0' i wr <1ly y y Ogpi kp0' wo kej 0' gf wli towr levo IRKF IRKF () vo n']4227. "Lwn('38 0']; "O ctvkp"J gmo cpp"*4223."O ctej +0'Hw| | { "Nqi ke" Kovtqf wevkqp0'] Qprkpg_" j wr < 1 y y 0 r m0 w/dgtrkp0f g" l¢cpf gtn'lgr ukrqp lhw | {kpvtq60 f h']4228. 'O ctej '42_0']32_'Detv'Mqumq"epf "Uevqtq"Kucmc"*Pq"Fevg+0"Hw| | { " Ngi ke0' 10 polygo Hatwpg" i wr <1 v v Orat wpgeky Oego 1" go cej kpgulg331: 81hw | {mi (j vo n']4227. "Lwpg'42_0"